JANUARY 22, 1960

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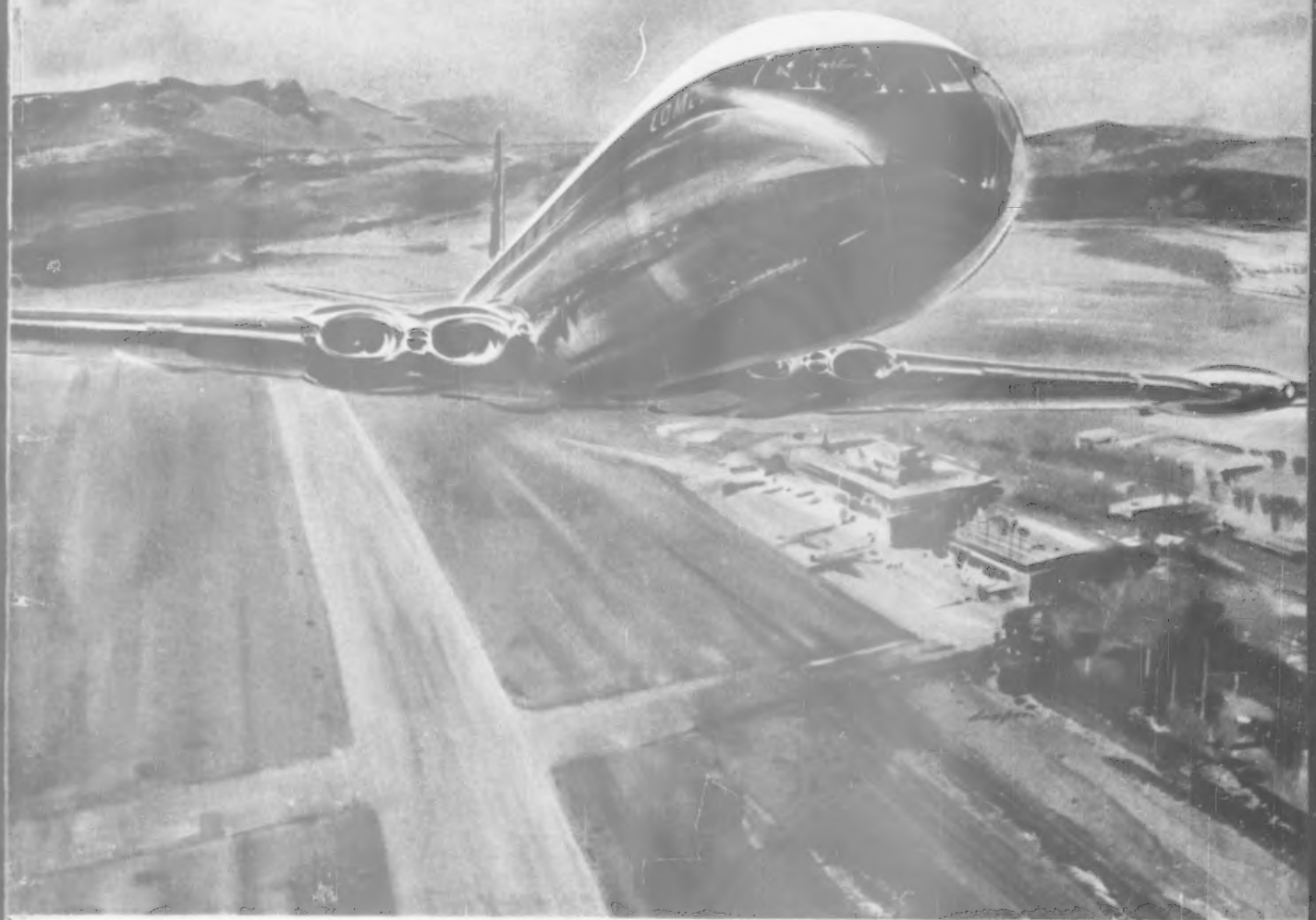

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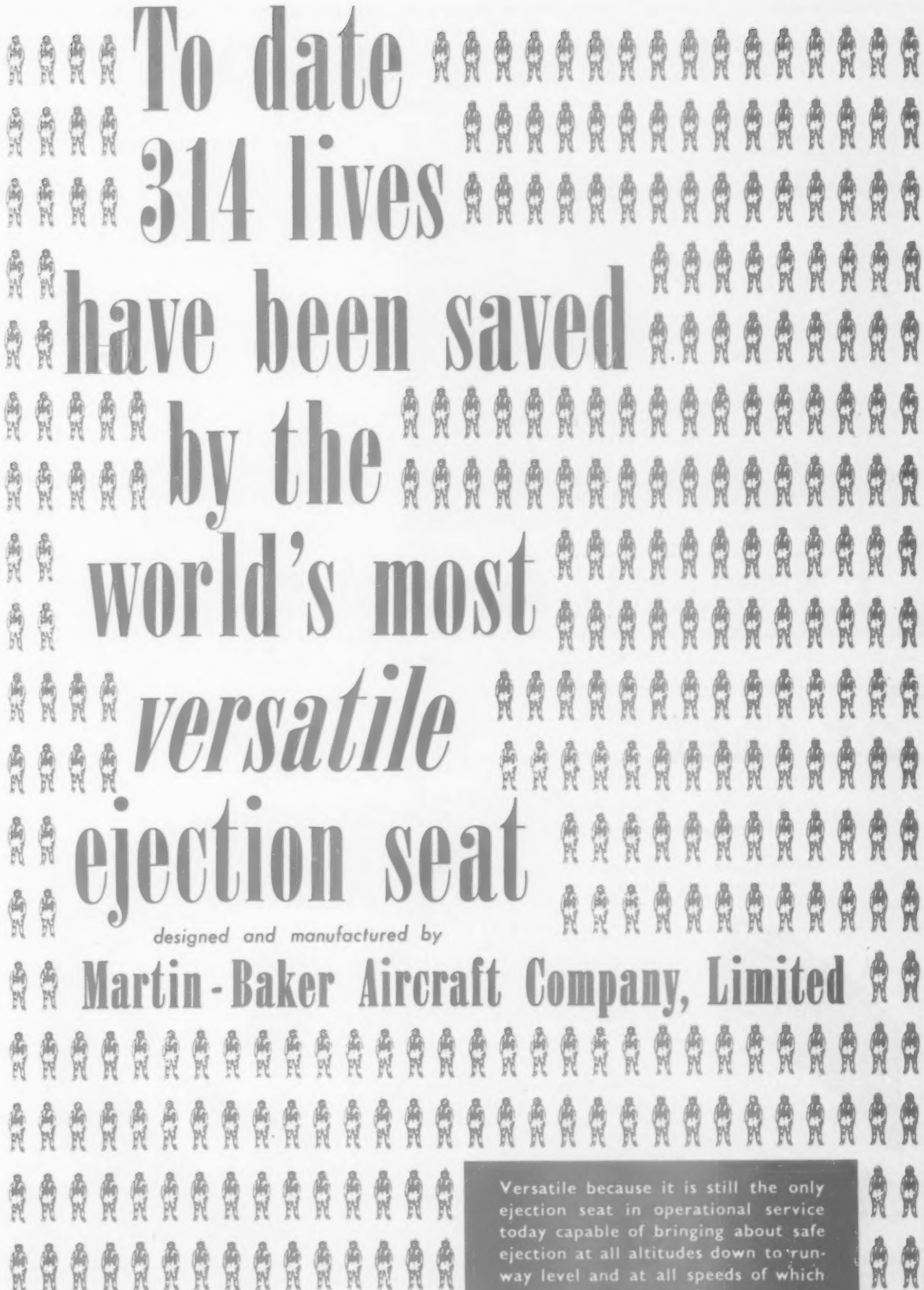

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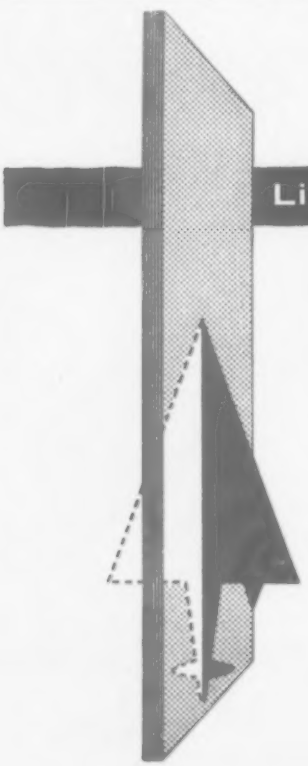

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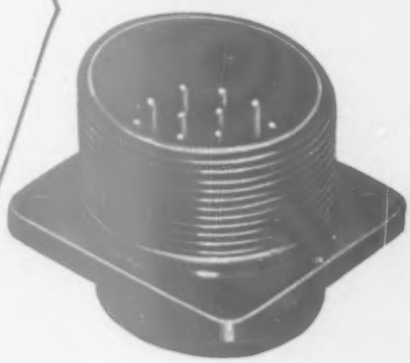

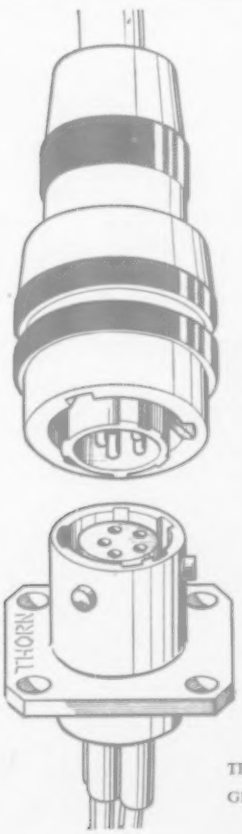

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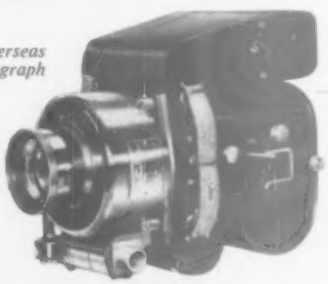

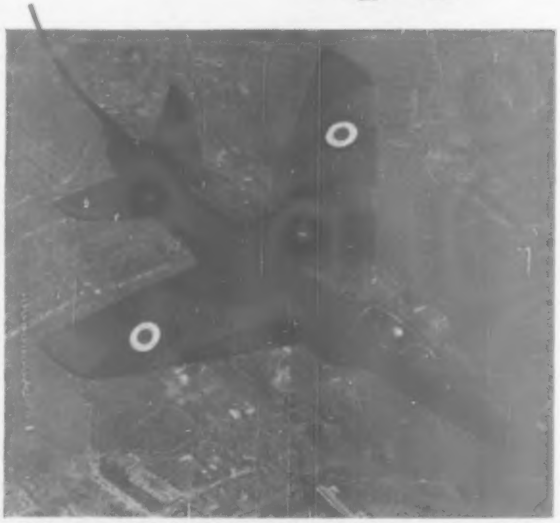

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2518 JANUARY 22, 1960

Two-Pronged Attack

Soon after this issue comes off the press B.O.A.C. will inaugurate its new Comet service across the South Atlantic and carry down the line a most distinguished list of passengers. In honour of the occasion we have compiled this special issue with the object of telling our friends in Latin America about the new service and about the activities of the British aircraft industry. At the same time our English readers will find, we trust, much to interest them about Latin America.

B.O.A.C. are playing an important part in strengthening the links with that continent, for not only are they now about to open this twice-weekly service across the South Atlantic, they have already extended their Britannia services across the Caribbean to Bogota, capital of Colombia.

May great success attend their efforts!

Sporting Efforts

Following the announcement of the composition of the British entry in the World Gliding Championships to be held in Germany in the early summer (see p. 94), the British Gliding Association has opened an Appeal for funds to assist with the preparation and equipping of the team. Once again the efficiency of the aircraft, trailers and vehicles has been assured by magnificent contributions from manufacturers.

Notwithstanding this help, the additional costs of entering the team of three machines, pilots and their crews is expected to reach £1,800. As in the past, each member of the team makes an agreed contribution to his own expenses. Many friends of gliding by giving help in previous years, whether in cash or kind, have seen that their contributions to those all-important World competitions have helped the team representing this country to emerge with outstanding credit and prestige. Once again the Association is asking for contributions.

Help will surely be forthcoming. We wonder whether a levy on clubs would not be a good idea.

Oil and Troubled Waters

Among recent aviation " events " which received prominence in the daily Press was the unfortunate mishap to a B.E.A. Viscount which suffered collapse of its nose-wheel during landing at London Airport and caught fire in the subsequent untidiness of its arrival. Considerable publicity was given to this accident—and, in one report at least, this meant that considerable publicity was also given to a remarkable statement, attributed to a B.E.A. spokesman, that " the engines of the plane were still all right, with the *petrol* still in the tanks." (Our italics.)

Hydraulic fluid was said to have caught fire. Strenuous efforts have been made for years to minimize this particular fire risk and, among other things, hydraulic systems are kept well apart from electrical systems. But accidents have an unfortunate habit of bringing closely together components kept far apart by design.

While the standard mineral-based hydraulic fluid is not highly inflammable it will burn and there has been a lot of research directed towards the development of more fire-resistant fluids for this purpose. This has certainly been successful but, unfortunately, improvements in the fire hazard situation have been accompanied by more problems concerning seals and high-temperature characteristics. As usual in aeronautical engineering, a compromise choice will have to be made.

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Matters of Moment

New Westland Helicopters

A BRITISH version of the Sikorsky S-61 twin-turbine amphibious helicopter is to be proceeded with immediately by Westland Aircraft, Ltd., and the company is also engaged on new developments of the turbine-engined Wessex and Westminster for civil and military use. These steps, announced in the chairman's annual statement, are all undertaken as private ventures, to help pay for which £1,000,000 has been added to the company's general reserve. They emphasize Westland's pre-eminent place among European helicopter manufacturers—a position which is to be consolidated by the purchase of Bristol's helicopter activities.

To be known as the Wiltshire, the Westland WS-61 will be similar to the Sikorsky airframe described in THE AEROPLANE AND ASTRONAUTICS for January 8, but will be powered by two Napier Gazelle turbines of about 1,800 s.h.p. each, compared with the 1,050-1,250 s.h.p. of the General Electric T58s used in the American version. Westland expect to have a Wiltshire flying before the end of this year (taking advantage of imported U.S. components) and describe the new aircraft as being for civil or military use, and able to carry up to 23 passengers.

Although Government support has not so far been obtained for the Westminster, the company has now decided to build a prototype of the production airline version, to fly by the middle of next year. Deliveries to civil operators could begin in 1962, and in this connection it has been announced in Rome that the Sardinian operator Linée Aerée Sardé has placed a letter of intent to order three Westminsters. The work and future plans of L.A.S. were described in our issue for November 6, 1959.

In anticipation of eventual military interest, Westland is also to build a full-size mock-up of the Crane-Transporter version of the Westminster. The chairman warns shareholders, in his annual statement, however, of the risk entailed in these Westminster developments which "may result in no future return."

A new version of the Wessex, to fly this year, will have two de Havilland Gnomes in place of the single Gazelle at present, and will be offered as a 14-passenger civil helicopter with particularly good performance at high altitude and in hot climates. This will be known as the Wessex 2.

The remainder of the Westland Group's range of helicopters, embracing aircraft from 500 lb. to over 33,000 lb. gross weight, includes the Rotorcycle (built by Saro for the U.S. Marines), the Skeeter, Widgeon, Wasp, Whirlwind, Gnome-Whirlwind and Wessex 1. To this list can now be added the Gazelle-engined Bristol 192. Of the arrangement with the Bristol Aeroplane Co., Ltd., the company states that agreement for the sale has been reached in "principle."

Subject to final adjustment, Westland will issue to Bristol two million 5s. shares, and will pay approximately £1 million in cash "to be paid in instalments as the proceeds of certain contracts to be taken over by Westland are received." Bristol, it is stated, has no present intention of disposing of the Westland shares to be allotted to it. They will be owned by the Bristol Aeroplane Co., Ltd., which will in future be a holding company, also having a 50% share in Bristol Siddeley Aero-Engines and a 20% share in the new Vickers/E.E.C./Bristol combined company.

Aid for The Industry

THE urgent need for the Government to adopt a vigorous policy of backing British industry in its efforts to sell its products overseas was among the many important matters referred to by Sir Thomas Sopwith, chairman of the Hawker Siddeley Group last week. He was giving his annual report to the shareholders, and his comments on the current aeronautical situation received widespread attention.

A measure of the problems facing our export efforts was indicated by his contention that foreign military, diplomatic and commercial representatives abroad often used every source of influence at their command on behalf of their national products. He cited the long-term credits offered by the American Export-Import Bank as another source of competition against which we cannot at present compete.

This led Sir Thomas to urge that the Government and the City should devise means whereby competitive long-term credit terms could be made available for British producers. Without such assistance, he emphasized, the industry's task of selling its wares abroad becomes "infinitely harder" and a lot of potential business is lost.

On the subject of the aircraft industry in particular, Sir Thomas said that it has been going through a period of difficulty, cutbacks and costly readjustments. "To denude it of support now," he said, "would imperil one of our greatest resources of industrial strength and indeed could threaten our very heritage."

Photograph copyright "The Aeroplane and Astronautics"

HAND-OVER.—Mr. C. H. Chichester Smith, D.S.C., chairman of Fairey Aviation Ltd., hands over to His Excellency the Indonesian Ambassador, Dr. Sunario, the logbooks of the first two of 18 Gannets ordered by Indonesia. The Fairey Company is also training the Indonesian naval pilots.

Speaking of the recent Hawker Siddeley offers to Blackburn and de Havilland, he said that in making them the Group was trying to meet the declared policy of the Government. Although the Group had not been particularly anxious to add to its aircraft interests in the U.K., the merging of these companies would consolidate the position of the Hawker Siddeley Aviation Company as the "foremost aviation enterprise on this side of the Atlantic."

If these offers are accepted it is proposed that Sir Aubrey Burke, chairman of de Havilland, should join the board of Hawker Siddeley and become deputy managing director. Mr. A. S. Kennedy, a director of de Havilland, and Mr. A. Jopling, chairman of Blackburn, will also join the board of Hawker Siddeley.

Wot Turboprop?

AFTER the Mikron-powered Hot Wot, and the Wet Wot floatplane we are now likely to see a Jet Wot, or, more accurately, a Turboprop Wot. Mr. Currie's ultra-light biplane, which started life before the War with a 36-b.h.p. JAP engine is now being fitted, very experimentally, with a Rover gas-turbine at Eastleigh.

With a rating of about 60 s.h.p., the Rover 1S/60 turbine, which is an auxiliary power unit for ground or air use, weighs 116 lb., dry, and therefore compares fairly closely with the Walter Mikron it is to replace. The Mikron-powered Wot is the second post-War prototype, and is being re-engined with the Rover engine on a largely empirical basis. The original fixed-pitch metal airscrew is being retained, and the unit started by windmilling from the slipstream of the Hampshire Aeroplane Club's civil Spitfire.

Because of the fixed-pitch airscrew, Mr. Vivian Bellamy, who has test-flown the post-war Wots, does not envisage taxi-ing the turboprop Wot, but hopes that it may be possible to get it into the air in its basically modified form, before exploring more sophisticated developments.

Agreements in Space-Research

INCREASED co-operation between all nations interested in space-science was foreshadowed at a meeting of the International Committee on Space-Research (Cospar) in Nice on January 16. The Cospar committee has suggested several important steps.

It was recommended that as far as possible the frequencies used in space-research should be standardized. Provision should also be made for switching off the transmitters of satellites once they have completed their useful life to prevent the radio-wave spectrum becoming needlessly "cluttered," to the detriment of

other experiments. Where changes were made in transmitting frequency, or in the orbits of satellites previously notified, these should be given well in advance to permit World tracking stations to participate fully in the experiments.

It was also agreed that all nations should work together to avoid unnecessary duplication of research projects; also to evolve standards for keeping space "clean" from bacteria which might be carried by probe rockets. Studies are to be made into improved methods of sterilizing space-vehicles. This problem of sterilization was considered especially important in view of probing experiments which are currently being planned to Mars and Venus.

The increasing attention now being given to interplanetary surveys is reflected by the fact that Prof. Joseph Kaplan, University of California, has been asked to summarize all available knowledge of conditions on Mars and Venus for the benefit of biologists who are now becoming interested in the problem of extra-terrestrial life. Meanwhile, Russian interest in sending probes to the nearer planets has been confirmed by Prof. A. Blagonravov, head of the Soviet delegation at the Cospar meeting.

Russia was hoping, he said, to send a new series of satellites into orbit round the Earth and to launch more probe rockets towards the Moon. Russian scientists were also preparing for a manned flight into space, but this would take some time. There were plans this year to send plants up in rockets as well as "highly organized living beings," but this the Professor emphasized did not mean men.

The Coming Importance of Research

NOW that some days have elapsed since the great luncheon given by the Royal Aeronautical Society to mark their Ninety-fourth Anniversary it will be profitable to reflect on the remarks made by Mr. Duncan Sandys, Minister of Aviation, who as we reported last week had some highly significant things to say. Those who are interested in portents and the manner in which things are done will not have overlooked the fact that our very determined Minister of Aviation chose to make his first public utterance in his new post at a gathering of the Royal Aeronautical Society.

There was a time when the doings of the Society were often in the news for this reason. The progress of the Society and the progress of British Aviation were joined in the public mind and, indeed, were seen to be so joined. In these days when the Industry is being compressed and hemlined, if not streamlined, it will be interesting to see whether the Society gets back to its one-time predominance in the news.

In his speech Mr. Sandys said that the Government were proposing to make some increase in the assistance given on the civil side. He had, he said, recently been discussing the matter with the Industry and hoped to make an announcement shortly of the policy in this matter. As the next three paragraphs of the Minister's speech were devoted to the certainty of civil airliners flying in the 1970s at two or three times the speed of sound and to showing how one 100-seat supersonic airliner could carry as many passengers a year across the Atlantic as an 80,000-ton liner, such as the "Queen Elizabeth," it can surprise no one if there is a feeling around that the first steps towards getting on with the job may soon be taken.

Before exploring this further it will be as well to see what else the Minister had to say. It is to be noted that he said we must press on with the development of passenger aircraft which can land and take-off vertically. He commented that the technical problems are now pretty well understood but that a very big effort will be needed before it can be made a commercial proposition.

The time has not yet come, said Mr. Sandys, to decide whether Britain should undertake an independent programme of space exploration, for without a British ballistic rocket we are not in a position to project satellites of our own. He went on however to record the really remarkable achievements of Black Knight and outlined what could be done by combining this with Blue Streak. He suggested that the practical benefits which may be derived from space exploration are likely to be far greater than can now be foreseen.

He said that British industry might well address its mind to the possible use of earth satellites in connection with communications. He did not overlook the potentialities of the hypersonic rocket-boosted glider. Almost his last remark was that it seemed virtually certain that human beings will be able to travel to the Moon and far beyond.

These remarks indicate, in our view, that the plans in this country for aviation and astronautics are very much more advanced than it has been usually assumed. And the interesting thing about these pronouncements is that they all have long-range objectives. Certainly, our re-grouped industry has got plenty to worry about in the way of orders to keep its strength up but it seems generally accepted that something will be forthcoming to justify the setting up of so many new

FAST FIGHTER.—English Electric's supersonic Lightning interceptor, powered by two Rolls-Royce Avons, is scheduled to join Fighter Command of the Royal Air Force within the next few weeks.

Photograph copyright "The Aeroplane and Astronautics"

establishments and to ensure, as some wit has said, that the shot-gun marriages shall not prove sterile.

We have always contended that if the country were to decide to press on with a supersonic aircraft the necessary research and development would demand a large and continuing effort by many sides of it. Such an effort would be one in which the country itself would be expected to take an enthusiastic interest. We think it a great pity that so little has been heard about the work of the Supersonic Transport Advisory Committee which has done much good work. More has been done in recent years than had been generally realised.

If we are going to have a supersonic airliner of our own, and early enough to prevent our Overseas Air Corporation from saying it will have to buy foreign once again, a great programme of research has got to be laid down now and in such a manner as to ensure continuing public support. A supersonic airliner is not going to be built in a day. In these comfortable days of ever-improving living standards the difficulties of impressing urgency upon the public become immense.

We foresee that a well-sustained public campaign will be necessary to ensure public enthusiasm for the supersonic airliner. It will be necessary to educate the people into realizing exactly how vital in the plans will be continuing research work at Government and industrial establishments alike. This really seems to us to be the main aspect of Mr. Sandys' remarks: the tremendous importance which research is going to play in the years ahead.

We shall not get supersonic aircraft, VTOL aircraft, space rockets, satellites, nor hypersonic rocket-boosted gliders, without long-term research on a generous scale. We cannot imagine that Mr. Sandys would have raised the points he did if the significance of these matters had not been understood and a way to set to work planned out.

For one thing has become abundantly clear and it is that the burden of developing the new generation of commercial aircraft has become a load too heavy for the widest-based consortium to bear.

A Designer of Experience

GEORGE CORNWALL, M.A., F.R.Ae.S., who died at Marlow on January 16, aged 63, had been chief designer, Heston Aircraft and Associated Engineers, Ltd., since 1934, when it came into being as the Heston Aircraft Co., Ltd.

During his long and happy time at Heston, he was responsible pre-War for the design of the Heston Phœnix and later in conjunction with Mr. Arthur Hagg of the Napier Heston Racer.

In co-operation with de Havillands he worked on the design of the Sea Hornet, a complicated and intricate task of conversion. During the War he was responsible for extensive design modification work on many American aircraft, and RATOG gear.

After the War Cornwall's design to M.o.S. Specification A2/45 Air Observation Post Aircraft obtained a contract for four prototypes. Later he was closely associated with Dr. Barnes Wallis on Wild Goose, the precursor to the Swallow. He played a valuable part in the early development of this project and he was very proud of this association.

His last major work, completed just before he fell ill nearly a year ago, was responsibility for the design, under the Vickers-Armstrongs (Aircraft), Ltd., Weybridge, of the empennage of Vanguard.

George Cornwall was an aeroplane designer with a vast and varied experience, he had a clear and analytical mind and was reliability personified. He had a grand sense of humour and was without doubt one of nature's gentlemen. He will be sadly missed by all his friends and colleagues at Heston, whose deepest sympathy is extended to his widow and son.—

G.A.L.

N. S. Norway—Engineer

TO those whose memories of the British aircraft industry go back to the early 'thirties the name of N. S. Norway means much. But because they are few in number compared with the myriads on each side of the Atlantic who avidly read each new book by Nevil Shute, most of the obituary notices which have appeared since his death on January 12, have had more to say about the writer than the brilliant aircraft engineer and mathematician who had spent 20 years of his life in the aviation industry, much of it in airships.

I remember well the first time I saw him. It was in 1931 and though officially in charge of the technical side of THE AEROPLANE I was spending all the time I could in helping to get the infant gliding business on its feet. It was thus natural that N. S. Norway should bring the plans of the Airspeed Tern sailplane into our offices in Piccadilly to discuss the possibilities of the design. It was, as one or two will remember, a high-wing sailplane of rather more elegant lines than many then current. Indeed it had the handsome fin and rudder of characteristic contour which were to distinguish future Airspeed designs with the exception of the Ferry.

We did not immediately see eye to eye about the design, for the smooth upper surface of the high-aspect ratio wing was broken by the opening for the pilot. I besought Norway to cover it in with a bubble canopy of some sort to improve the induced drag but in those days Perspex was not available and the construction of such a device was difficult. Norway was sure that the gliding angle of his machine was good enough to ensure the capture of various British records and it was the publicity resulting from these with which he was most concerned. The occasion marked for me the beginning of a long and always stimulating acquaintance. It also served to emphasize the ability of my new friend of sticking to a solution once he had weighed a problem up.

It was not long before one was going up to York to see the infant company in being and the work being done on the strange Air Ferry, a trimotor biplane built specially for Sir Alan Cobham. After that progress seemed swift. There was the Courier, the most exciting creation of its kind in the country at that time. Norway in his autobiography gives credit to a rather bad photograph in THE AEROPLANE as a catalyst for the design.

This machine was something quite new. A low-wing monoplane of high performance built behind a radial engine and relying on a hydraulically operated retractable undercarriage for its superior performance. In those days the pundits in learned conclave at R.Ae.S. meetings used to explain that such things as retractable undercarriages and controllable-pitch airscrews were not worth the complexity. In such a novel design things did happen unexpectedly. On one occasion the new machine was being flown over the Solent when the pilot was startled to have the windscreen fly away from him into space.

The success of the Courier was such as to bring into being the twin-engined Envoy based on the same design. These machines achieved fame by being engined with the Wolseley radial from the Nuffield stable. Unfortunately there is not room here to tell all that story. From the Envoy came the Viceroy, a special overload version for a bigger engine in which the necessary extra strength was got by applying the plywood diagonally. From this machine of which Norway has a splendid story to tell in his autobiography came the Oxford. Over 8,000 were built and of these only 40 short of 5,000 by Airspeed itself.

But by the time War came Norway had left the company he founded. The reasons behind this are set out with complete objectivity and characteristic modesty in "Slide Rule." By the summer of 1938 Norway found himself with enough money to live on and no work to do. Very shortly afterwards his book "Ruined City" earned him a great deal of money for film rights. I remember that he was able to buy himself a yacht, "Runagate" I think it was called, and in the summer before the War he asked me to go to France to help him sail it home.

When War broke out he went to work with Sir Dennistoun Burney on a gliding torpedo, but in June, 1940, he was so convinced that the country could only be saved by every man jack taking up arms that he joined the R.N.V.R. as an elderly yachtsman (he was born in 1899). Consequently, he was furious when the Admiralty almost at once sent him to join the "Wheezers and Dodgers" as the Department of Miscellaneous Weapon Development was called.

A splendid account of what he and his colleagues did in the next five years will be found in a book to which Norway wrote a foreword: "The Secret War" by Gerald Pawle. It should be read not only for itself but also as a sequel to "Slide Rule" which ends with Norway leaving Airspeeds.

Later on I remember an impromptu protest meeting in my office here on the reasons which had led Nevil Shute, the famous novelist, to leave England for Australia. Later he called again to arrange for the reproduction of some maps from THE AEROPLANE in one of his books. The last call I had was to ask if I could arrange for Mrs. Norway to see the recovered pieces of the Comet at Farnborough. Thanks to Arnold Hall, then superintendent of the R.A.E., I was able to arrange this. Naturally to the author of "No Highway" an eye-witness account of the findings of this disaster was of the greatest significance.

Others have written, with much greater qualifications than mine, of his work as a writer. Let them write. I have Nevil Shute's assurance that his heart never turned from his first love. In "Slide Rule" he wrote:—

> "For once a man has spent his time messing about with aeroplanes he can never forget their heartaches and their joys, nor is he likely to find another occupation that will satisfy him so well, even writing novels."

T.J.

BIRTHDAY PARTY

As reported last week, some 450 people attended the 94th anniversary luncheon in London on January 12, of the founding of the Royal Aeronautical Society. The occasion was also to celebrate the 50th anniversary of the Golden Year, 1910, of British aviation. These copyright photographs show some of the guests at the 45 tables.

Above, Sir Sydney Camm, past-president (left), listens to Capt. Laurence Pritchard—for many years secretary of the Society. Mrs. Pritchard (right) wears dark glasses against the flashlights.

Above, a pause in discussion between Mr. Duncan Sandys, Minister of Aviation, and Mr. Peter Masefield, President of the Society. They both discussed the White Paper on Defence in their speeches.

Left, Sir Bennett Melvill Jones (centre) listens to Capt. A. Majendie, left. Right, Mr. D. L. Brown.

Above, Mr. and Mrs. Potts with Mr. F. Winter. Above, right, Dr. A. M. Ballantyne (left), secretary of the Society, talks to Mr. Cecil Field.

Above, Lord Douglas, Major G. P. Bulman, past-president, R.Ae.S., and Sir Thomas Sopwith, who was flying in 1910.

Above, Mr. Philip Wills, Miss C. Babington-Smith, Mr. Philip Lucas. Above, right, Brig.-Gen. Osborne Mance, who joined the Society in 1899.

Below, Mr. H. Hemsley and Air Cdre. Paul. Below, right, Lord Sempill, Sir George Gardner, Air Chief Marshal Sir Francis Fogarty and Mrs. Rodwell Banks.

Above, Air Cdre. Wheeler, Mr. D. L. Hollis Williams and Mr. R. E. Leete.

Aviation News in General

JERSEY BOUNCE.—A radio station in Holmdel, New Jersey, successfully "bounced" radio signals from a 100-ft.-dia. inflatable test-satellite launched at 250 miles altitude by a two-stage rocket fired from Wallops Island, Virginia, on January 17. The signals were successfully received at Round Hill, Massachusetts. An attempt will be made this spring to launch a similar inflatable sphere into orbit.

U.S./FRANCE SPACE TEST.—It is reported that the United States have asked the French to provide facilities in Western Europe for receiving short-wave messages broadcast from America and reflected off the 100-ft. inflatable satellite to be put into orbit at a height of 900 to 1,000 miles by the three-stage Delta rocket.

FIAT HELICOPTERS?—Following demonstrations of two Alouette 2s and a Djinn by Sud Aviation for the Italian Army, Fiat announced it would be prepared to manufacture the Alouette under licence if a substantial order was placed by the Italian Army. The demonstration included a flight to the 12,500-ft. summit of the Ortles by the Djinn and an Alouette with one and two passengers respectively.

ADEN INSPECTION.—The Under-Secretary for Air, Mr. W. J. Taylor, M.P., left London Airport on January 18 in a Transport Command Comet to visit R.A.F. units of British Forces Arabian Peninsula. He will also inspect the R.A.F. station at El Adem, Libya. Mr. Taylor is accompanied by Mr. J. Dance, M.P., Parliamentary Private Secretary to the Secretary of State for Air; Air Vice-Marshal W. P. G. Pretty, Director-General of Organization and Mr. W. G. M. Anderson, Director-General of Works.

AUSTRALIAN HELI-SERVICE.—During 1960, scheduled helicopter passenger services are to be opened in Melbourne and in Sydney, linking the airports and city centres. Twin-engined, 20-passenger helicopters are on order for these services.

ORENDA DIVERSIFICATION.—Orenda Industrial, Ltd., a wholly-owned subsidiary of Orenda Engines, Ltd., a member of the A. V. Roe Canada Group will "market, service and provide engineering support" for the complete range of Standard-Triumph's diesel, gasoline and natural gas engines covering the agricultural, marine and general industrial fields.

INTERNATIONAL CONTEST.—Entries for the World Gliding Championships, to be held near Cologne in June, have been limited by the German Aero Club to three per nation. The British Gliding Association nominated the following for the British Team: Open Class: Cdr. H. C. N. (Nicholas) Goodhart, R.N. (Eon Olympia 419) and Lieut.-Col. A. J. (Tony) Deane-Drummond (Skylark 3). Standard Class: Cdr. G. A. J. (Tony) Goodhart, R.N. (Skylark 2). Reserve pilot: David H. G. Ince.

CANADIAN DOPPLER NEWS.—Irish Airlines have ordered nine complete Doppler installations, ARINC version CAM623, for installation in their three Boeing 707s.

FRANCO-AMERICAN LINK.—M. Andre Esperet of Paris has been appointed an assistant to William P. Gwinn, president of United Aircraft Corporation. M. Esperet was formerly commercial manager of the French Société Nationale d'Etude et de Construction de Moteurs d'Aviation (SNECMA).

BRAZILIAN ORDER.—Twelve Bell 47G-2 Troopers have been ordered by the Brazilian Air Force. The helicopters are to be used for training as well as search and rescue operations.

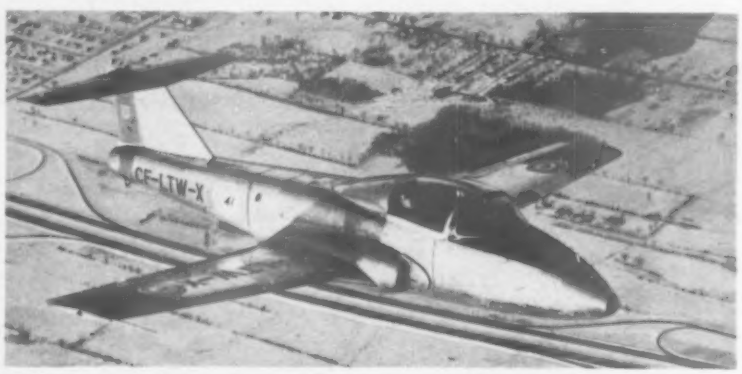
HELICOPTER AMBULANCE.—The Australian Royal Prince Alfred Hospital, Sydney, is to introduce a helicopter ambulance service, using a heliport on top of an accident and emergency hospital to be built nearby. The £A1 million project will be financed by public appeal.

FOR ANTARCTICA.—A Dakota, modified for Antarctic flight, is being transported by the Danish Polar ship "Thala Dan" to the Australian Antarctic base of Mawson. The aircraft has skis and an auxiliary jet engine to enable it to take-off from 150-yd. ice runways.

PROPELLER PROGRESS.—Last week, flying hours achieved by de Havilland propellers on Britannia aircraft reached the one million mark.

SWISSAIR HANGAR.—Last month Swissair opened its 230-ft. by 180-ft. maintenance hangar at Idlewild, New York. Designed for DC-8 maintenance, the hangar includes an operations centre and airline facilities building.

MIRAGE 3 ORDER.—Several hundred Dassault Mirage 3s have been ordered for the French Air Force. An initial batch of 100 is now being produced, and a second batch is provided for in the 1960 French budget. The Mirage 3B exhibited at the Paris Show has now flown.



FIRST FLIGHT.—The Canadair CL-41 trainer made its first flight from the company's plant at Cartierville Airport, Montreal, on January 13. Airborne for 70 min., it was flown by Ian MacTavish, assistant chief pilot of Canadair engineering flight test.

Commercial Aviation Affairs

COMET DELIVERIES.—Nineteenth and last of the B.O.A.C. Comet 4s was delivered on January 11. All have been delivered on, or ahead, of contract dates; and six others have been delivered in the same time—three to B.E.A. and three to Aerolineas Argentinas. By January 9, 1960, B.O.A.C. had flown 437 million passenger-miles with its Comets, carrying 120,000 passengers in 27,160 revenue flying hours.

ALL-GHANA?—Last week the Ghana Minister of Transport and Communications said that his government would take over B.O.A.C.'s shareholding in Ghana Airways, whilst retaining the Corporation's management services. Obviously this must be an eventual aim, but no immediate action seems to be likely pending the completion of technical and other training for Ghana nationals. B.O.A.C.'s holding in Ghana Airways is 40% of the nominal capital of £400,000.

MEXICAN DELIVERY.—The first of three Comet 4Cs ordered by Mexicana for its Golden Aztec services from Mexico City to Chicago, Los Angeles and Havana was delivered from Hatfield to Mexico City on January 14. The 5,800-mile flight via Gander and Chicago took approximately 15 flying hours.

ARGONAUTS FOR ADEN.—Three Argonauts (Canadair North Stars) have been purchased by Aden Airways from B.O.A.C. All will be delivered by the end of April. Only four of the original B.O.A.C. fleet of 22 Argonauts now remain unsold.

AMBASSADORS FOR SHELL.—Two ex-B.E.A. Elizabethans are being converted by Field Aviation Services for use as V.I.P. transports by the Shell Petroleum group.

BOGOTA INTERNATIONAL.—The new international airport at Bogota, Colombia, is now open to traffic, replacing the small Bogota-Techo airport. Bogota International, 9 miles N.W. of the city, has a 12,500-ft. runway built to ICAO standards and a 10-storey terminal building including the control tower. The International Co-operation Administration provided funds for the project and the F.A.A. provided technical assistance.

U.K. TRAFFIC UP.—A 19% increase in U.K. airlines traffic in 1959 is indicated by provisional M.o.A. figures. Load short-ton miles performed on scheduled and inclusive tour services totalled 404 million compared with 341 million in 1958. Capacity short-ton miles were up by 14%, and overall load factor improved from 59% to 61.5%.

SWISSAIR APPOINTMENT. — Mr. M. Pannetti has been appointed Swissair passenger sales superintendent for London and Southern England. He is succeeded as senior sales representative in the West End by Mr. Peter Clark.

C.P.A. DOPPLER.—Collins Doppler navigating equipment has been selected by C.P.A. for installation, in duplicate, in its four Conway-engined DC-8s.

NASSAU SERVICES.—B.O.A.C. will introduce its Comet services between New York and Nassau on January 30 (see our issue for December 4, 1959, page 558). Scheduled passenger and freight service rights on the routes Nassau-Miami and Miami-Havana have been granted by the U.S. to Eagle Airways (Bahamas), Ltd. The Nassau-Miami service will be inaugurated on March 1, using Viscounts at an initial frequency of four return services a day. The company has also been granted unlimited charter rights on these routes.

CONVAIR TESTS.—Engineering flight tests of the Convair 880 were complete in all but a few details by the end of 1959. A provisional C. of A. was issued by the F.A.A. on December 18 and the three test aircraft are now being used for the F.A.A. flight test programme to obtain the full C. of A. before May 1. After completing stability and control demonstrations for the F.A.A., the first Convair 880 will be modified, during the spring and summer, to the Capital Airlines 880M configuration, with leading-edge slats, large (Convair 600) fin, power-boosted rudder and, eventually, CJ-805-3B engines.

NAVAL VISITORS.—During a recent visit to Sir W. G. Armstrong Whitworth Aircraft, Ltd., members of the Indian Navy saw India's first Sea Hawk. Left to right, Cdre. R. B. Law, C.O., the first Sea Hawk squadron I.N.; Mr. J. Butter, A.W.A.; Cdre. T. S. Rajan, I.N.; Capt. R. S. David, I.N.; Cdre. I. Singh, I.N.; Mr. A. R. Hall, A.W.A.; and Mr. B. P. Hough, A.W.A.

CONWAY DC-8 ON TEST.—In the course of its functional and reliability tests for the F.A.A., a Conway-engined DC-8 recently flew from Long Beach to Mexico City in 2 hr. 54 min. It flew on to Bogota, Port of Spain and Miami before returning to Long Beach.

PACIFIC SERVICES.—On January 15, Pan American opened a daily jet service between San Francisco and Tokyo with Boeing Intercontinentals. Two services a week are non-stop, the others going by way of Honolulu. On March 14, United Air Lines will introduce DC-8s on Pacific routes, with six round trips a week each between Los Angeles and Honolulu and San Francisco and Honolulu.

T.W.A. DAILY SERVICE. — On January 18, T.W.A. increased the frequency of its New York-London-Frankfurt and New York-Paris-Rome jet services to one a day.

I.A.L. HELP FOR NIGERIA.—International Aeradio has concluded an agreement to provide aeronautical telecommunications engineering staff for service in Nigeria. Their duties will include the supervision of the installation, operation and maintenance of aeronautical telecommunications facilities—air/ground equipment, airport VHF and navaids.

AMERICAN TRAFFIC.—In 1959, American Airlines increased its revenue passenger miles by nearly 15% to a record 5,738 million. The number of passengers increased by 4% and airfreight improved by almost 10%.

ACCIDENT CAUSE.—The crash of an American Airlines Electra during the approach to La Guardia on February 3, 1959—twelve days after the type went into service—has been blamed by the C.A.B. on the crew's failure to give proper attention to instruments. The crew's limited experience and incomplete training were cited as contributory factors. The accident probably could have been prevented "had the first officer followed prescribed operating procedures and been fully alert . . . to all his cockpit duties."

News About People

B.S.E. APPOINTMENT.—Mr. J. F. Robertson, C.A., has been appointed a director of Bristol Siddeley Engines, Ltd. Financial director and treasurer of the Hawker Siddeley Group, Mr. Robertson has been with Hawker Siddeley since 1938 and is a director of many of the companies within the Group, including Hawker Siddeley Aviation, Hawker Siddeley Industries, High Duty Alloys, Aluminium Wire and Cable, and Self-Changing Gears.

BOEING CHANGES.—A series of top-level appointment changes has been made by Boeing to provide greater autonomy for the managements of each division. Mr. John O. Yeasting has been appointed vice-president—general manager of the Transport Division, in place of Mr. Bruce Connelly, who becomes vice-president—assistant general manager, with special responsibility for sales and contract administration. Mr. Clelland B. Gracey is now vice-president—general manager of the Wichita Division (building B-52s) in succession to Mr. N. D. Showalter, who is appointed special assistant to Mr. Wellwood F. Beall, the senior vice-president. Mr. James P. Murray has been succeeded by Mr. Clifford E. Roberts as manager of the Washington office after 31 years, but remains a vice-president and advisor to the management.

CHANGES AT GODFREY.—Mr. R. W. Everal, M.I.P.E., F.I.G.M., A.F.R.Ae.S., becomes managing director of Sir George Godfrey and Partners, Ltd., and its associate Sir George Godfrey and Partners (Industrial), Ltd.; he has been director and general manager since 1950. Mr. W. G. Williams, M.I.P.E., M.B.I.M., A.R.Ae.S., works manager since 1950, has been appointed a director of Sir George Godfrey and Partners, Ltd. Mr. J. Leach joined the company on January 1 as chief engineer; he was previously flight test manager at Vickers Armstrongs (Aircraft), Weybridge.

NAPIER REPRESENTATION.—D. Napier and Son, Ltd., have appointed Mr. F. J. Cox as resident technical representative in South-East Asia, covering Burma, Borneo (including British North Borneo, Brunei and Sarawak), Indonesia, The Federation of Malaya, Singapore and Thailand. Mr. Cox has been with the company since 1947 and has been resident engineer in Burma since 1956.

AIRTECH SALES.—Mr. R. B. Young has joined Airtech, Ltd., as sales manager. He will be responsible for sales of all the company's products, in particular those in the commercial field. Since 1950 he has been with the Telecommunications and Electronics Division of The Plessey Co., Ltd., dealing with equipment sales.

Air Transport

Slowly Does It

AN interesting, if not wholly unexpected, situation is developing on the North Atlantic routes, in which a certain class of traveller is rejecting the jet services in favour of a rather more leisurely crossing. Resisting the sometimes-exaggerated claims of the airlines for their newest, fastest and "non-stoppest" equipment, these travellers choose an aeroplane which takes long enough on the journey for them to get a full night's sleep.

They are interested in de luxe class services and usually want sleeping berths. They do not want to lose half a night's sleep, or endure a 20-hour working day as a result of crossing the Atlantic too quickly. Many of them are travelling at their own expense and they are, no doubt, only a small minority of passengers on the Atlantic services. They are, none the less, important.

B.O.A.C. finds itself well placed to cater for the tastes of both worlds with its Comets, Britannias and—after next April—Boeing 707s. At the end of the next summer peak, the Comet will be withdrawn from the Atlantic services, for which it was never really designed, but the Britannia seems ideally suited to the needs of the luxury traveller and could remain usefully employed in this way for quite some time. Not the least interesting aspect of this situation is that the passenger who pays most will be travelling in the oldest aeroplane while the masses will be able to afford to go only in the newest.

A factor in this trend which few airline executives would wish to comment upon may have something to do with the "apparent" safety of the aeroplane being used. This has nothing to do with statistics, but a lot to do with natural reactions of the human nervous system—which can perhaps be forgiven for believing that the more slowly an aeroplane flies, especially when landing and taking off, the safer it is.—F.G.S.

A Contemporary View

FOLLOWING our comments in last week's issue (p. 62) it was interesting to see those of our U.S. contemporary, *Aviation Week* (January 11), about the F.A.A. statement on its Decca tests.

Apparently the full report has not yet been approved by the Agency's National Aviation Facilities Experimental Center (which conducted the tests) and was not due to be seen by the F.A.A.'s Bureau of Research and Development until later this month.

The journal points out that the New York test installation was originally stated to be intended by the F.A.A. for evaluating a hyperbolic system for use by helicopters in a high-density terminal area. As a result, smaller aerials than those normally employed were installed, "giving an effective radiated power which is only one-fifth that of the English Decca chain. This," *Aviation Week* continues, "is one possible explanation for the tracking pen deviations reported by F.A.A." The base-length of the chain is, too, much less than standard and would not provide accurate cover as far away as Boston.

One point which could not be elaborated in last week's issue concerned the F.A.A. statement that the equipment did not fulfil "steering" requirements and that "pilots were unable to maintain a constant heading . . . without the aid of other instruments." This is a criticism which could be applied to any ground-based navigational aid unless the aircraft is flying directly to or from a transmitter; in all other conditions heading information is required.

What is a "Closed Group"?

NOT altogether unexpectedly the Commonwealth Union of Trade/Eagle Aviation plan (see our issue of January 8, p. 33) has run into difficulties. The Ministry of Aviation does not apparently consider C.U.T. to be a "closed group" organization in the sense which would permit it to charter aircraft for the use of its members—though the Union claims that it has other aims than the provision of cheap air fares for its members. It was set up about a year ago and the membership subscription is £3 10s.

The question of whether or not a particular charter operation or series of operations is permissible in the existing monopolistic situation is one for the legal specialists and the entire written law of the matter is contained in one little sentence. This—which we quoted in the January 8 article—can be found in Section 23 of the Civil Aviation Act of 1946, and in Section 24 of the Air Corporations Act of 1949.

In the case of the C.U.T./Eagle arrangement the legality of the operations depends not on whether the "series of journeys . . . together amount to a systematic service," but on whether this service is being "operated in such a manner that the benefits thereof are available to members of the public from time to time seeking to take advantage of it."

Short-haul Prospects

ALTHOUGH Douglas Aircraft publicly announced plans for its short-haul DC-9 some six months ago it now seems certain that the aircraft will never be built in the "baby-DC-8" form then illustrated. Since the announcement was made, the company has remained silent on the progress of this project—for which no orders have yet been placed—but it is no secret that Douglas is under pressure from the airlines to adopt a rear-fuselage engine layout, probably using two engines à la Caravelle.

The significance of the recent visit by a Douglas engineering team to Sud-Aviation at Toulouse is obvious in this context. United Airlines, which Douglas regarded as a likely sponsor for the DC-9, is known to have been favourably impressed with the French product, which in its Caravelle VII version is now being offered in the American market with 16,100-lb.s.t. General Electric CJ-805-23 turbofans rather than the 14,000-lb.s.t. Rolls-Royce RB.141s.

In a year-end review of Douglas activities, Mr. J. R. McGowen, the vice-president responsible for commercial

(*Continued on page 97*)

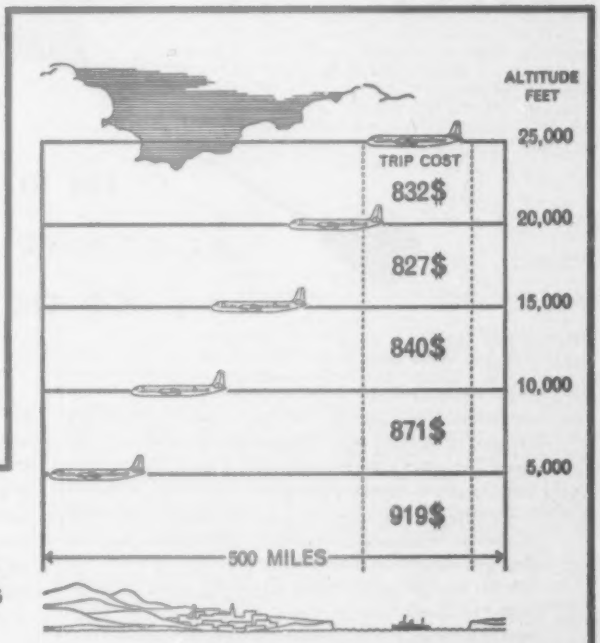
DELTA DOUGLAS.—This unusual view of a Douglas DC-8 in Delta colours shows the unique Douglas-designed noise-suppressors or "ejectors" in the open position, with the rear portions of the nacelles slid back exposing the thrust reversers and forming an annulus round the exhaust nozzle.

Only the VANGUARD
has this proved flexibility

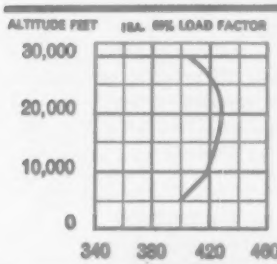
AIRLINE OPERATORS are invited to look carefully at this diagram and graph, and then compare the Vanguard's flexibility with their own experience of short haul operation on high-density routes.

It is easy to see that this remarkable aircraft can be routed at altitudes of from 5,000 ft to 25,000 ft and above, with practically no penalties in operating costs or speed.

The difference in direct cost between a 500-mile sector flown at 10,000 ft and one flown at an optimum of 20,000 ft is only $44 per trip. A cruising speed of over 400 m.p.h. is available between the height bands of 5,000 ft and 30,000 ft., so that schedules can be maintained irrespective of routeing instructions.



LOW LEVEL ROUTEING IMPOSES NO FINANCIAL STRAIN WITH THE VANGUARD



SPEED CAN BE MAINTAINED WHATEVER THE ALTITUDE ROUTEING INSTRUCTIONS

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

D

SURVIVAL DEPENDS ON VERSATILITY

IN DEFENCE AGAINST AIR ATTACK AS IN NATURE

The story of evolution is the story of success, or failure, in versatility. Those animals that could adapt themselves to changing conditions of life multiplied, flourished and survived. Those that were too set in their ways died out.

It is not only in Natural History that versatility – the ability to perform more than one function – is of critical importance. It is equally important in the field of defence against air attack. If we ever again have to defend ourselves against attack from the air, the one certain thing is that the pattern of attack would be chosen so as to make things as difficult as possible for the defence. The less flexible our methods of defence, the more easily they could be baffled.

VERSATILITY IN DEPLOYMENT

A vital weapon for defence against air attack is the guided missile. Missile systems can either be permanently sited on fixed concrete emplacements, or, like the English Electric Thunderbird, be made fully mobile, moved across country in standard military vehicles, and redeployed in a few hours.

The important thing is that the second category – and this means Thunderbird – can also be used in a static role. It can stay put on a chosen site for as long as that site continues to be the most suitable one. It doesn't have to be concreted in: and this saves money and man hours.

But if the unexpected happens – and in war it always does – Thunderbird can be away and in action again to meet a new threat overnight. It is operationally flexible. Now in service with the Army, its inherent mobility allows for quick changes in plan, easy resiting of defence and provides the versatility which is of ever increasing importance to present and future air defence.

EVOLUTION CONTINUES

An even more advanced version has been under development for some time and is well under way. Amongst other improvements, Thunderbird's successor will provide longer range and increased low-level capability whilst still retaining its full mobility and air-transportability. Evolution, in fact, is still going on – an evolution which, as in nature, will still further increase the versatility of the Thunderbird Weapon system, upon which our survival may depend.

'ENGLISH ELECTRIC' THUNDERBIRD

ENGLISH ELECTRIC AVIATION LIMITED · *GUIDED WEAPONS DIVISION* · LUTON · STEVENAGE · WOOMERA

A MEMBER OF THE ENGLISH ELECTRIC AVIATION GROUP

GW 28

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programmes, recently said this, in an obvious reference to the DC-9: "Although there is every indication that airlines will need a smaller pure jet transport for operation over short to medium ranges, the timing for the introduction of such a new model remains a subject of study and discussions with airline operators." He might have said, too, that the optimum size and performance of such a project also remain open to discussion. Among the projects in the general category of short-haul (Viscount/Convair replacement) turbojets are aircraft to accommodate from 50 to 140 passengers and with design ranges of from less than 1,000 to about 3,000 miles.

Of the U.S. manufacturers, only Douglas so far has showed its hand—and even this as it now appears, was no more than a dummy. Boeing has kept very quiet about its short-haul 727, but latest information suggests an aircraft of about 110,000 lb., with 1,250 sq. ft. of wing area. Twin, triple and four-engined layouts with Pratt & Whitney and Rolls-Royce turbofans have been studied and a rear-engined layout with three R.B.163s is currently favoured. Convair has not announced plans for anything smaller than its 191,000-lb. 880M for Capital Airlines, but has recently been reported to be negotiating with Sud Aviation for a Caravelle licence and is understood to have its own triple-engined projects under consideration.

On this side of the Atlantic, the Airco D.H.121 is the only "firm" project other than the Caravelle. In its B.E.A. form, the D.H.121 (see pages 98-99) weighs 105,000 lb., carries up to 100 passengers and has a range of 1,000-1,200 miles. With centre-section fuel the weight increases to about 112,000 lb. and the stage-distance to about 1,500 miles.

The Airco D.H.121 is now, in effect, the Hawker Siddeley Group's stake in the short-haul field. The Vickers/English Electric/Bristol group has several current studies to choose from but is most likely to back the VC11, a member of the VC10 family designed for ranges up to 3,000 miles carrying up to 138 passengers and powered by four 10,100-lb. Rolls-Royce R.B.163s (the engines used in the D.H.121). The VC11 is a strong contender for Government financial backing and interest has been reported from T.C.A. and Continental Airlines.

There is now little likelihood that the Bristol 205, with rear-mounted Bristol Siddeley turbofans, will be developed in addition to the VC11, but if Hunting Aircraft joins this group of companies, as has been suggested, its H-107 might proceed, as it does not conflict with the Vickers aeroplane. The H-107, with two 7,000-lb. s.t. Bristol Siddeley B.E.61s, carries 56 passengers over ranges up to about 800 miles.

The Caravelle VII is slightly larger than the existing Avon-engined version and is offered for service in 1963, carrying up to 85 passengers over ranges up to about 2,000 miles. When announcing the DC-9 last August, Douglas offered delivery early in 1963, but this date was clearly subject to sufficient orders (75-100) being obtained for an early start to be made. Of the various short-haul projects, probably only the D.H.121 can now match the Caravelle VII deliveries.

No Violence

NATIONAL AIRLINES pilots, through their local ALPA branch, have refused to undertake in future the mandatory bi-annual proficiency checks required by the Federal Aviation Agency. The pilots' action, which would logically lead to the invalidation of their licences and the closing-down of operations by the airline, has been taken on the ground that the proficiency checks require violent aircraft manœuvres to be made, which are "not necessary and are injurious to the airframe."

The pilots' opinion has been influenced by two recent fatal accidents involving National Airlines aircraft, and more particularly that to a DC-6B on January 6. Preliminary investigations indicated that the DC-6B broke up in the air but the latest information, according to a C.A.B. investigator, suggests that a bomb was exploded in the aircraft by a passenger.

Concern about the danger of exceeding operating-limit speeds with turbojet transports has recently been expressed by the F.A.A. itself. Flight-recorder data suggest that limit speeds are being exceeded on "a large percentage of flights"—presumably because of the nearness at high Mach numbers of the normal operating maximum to the never-exceed speed.

Used Aircraft Market Trends

YEAR-END surveys of the state of the used aircraft market by two leading U.S. organizations both emphasize that further reductions in the prices of piston-powered commercial transports and business aircraft can be expected. The reports were made by Mr. Robert I. Helliesen, president of Aircraft Exchange, and Mr. Joseph T. Barta, a partner in William C. Wold Associates, international transport aircraft brokers.

Mr. Helliesen had this to say about the condition of the market for the common types of transport:

DC-3 and C-47. "... in plentiful supply ... demand is also brisk ... in really first-class condition bring about the same prices as early in 1959."

DC-4. "... really good DC-4E cargo-passenger aircraft ... most in demand. Prices have remained practically unchanged during 1959."

DC-6. "... in fair supply, but demand is greater for the DC-6B even at substantially higher prices ... sales [of DC-6B] are slowed ... by financing problems. The demand for the long-range DC-6B is particularly good ..."

DC-7 and DC-7B. "Asking prices ... dropped considerably during 1959 but, with sales near the zero level, further price reductions may be necessary."

L-749 and early L-1049s. "Prices ... have dropped to the point where buyers are again showing interest ... the proper price level may not yet have been reached."

Convair 240. "... a temporary over-supply ... slightly depressed the market in 1959. Corporate demand provides a good market for all Convairs."

Convair 340 and 440. "... move satisfactorily and prices have remained steady ... turboprop conversions provide added demand."

DC-6A and L-1049H. "... prices ... remain considerably higher than those of comparable passenger types."

Curtiss C-46. "... prices ... have shown only slight decreases in 1959."

Mr. Helliesen noted that the DC-7s, L-1049Gs and L-1649s which entered the market in 1959, in some cases only two years old, were offered at less than half of the original cost but were the least useful of all the models on the market for short-haul passenger services. Conversion to cargo configuration might provide a partial answer (there was "a spectacular increase in air cargo volume during 1959") but because of the high cost of such conversion prices might have to drop further.

Mr. Barta also referred to the rapid growth of the cargo market—and an increase in charter operations—as factors likely to help absorb the larger types of airliner coming on to the market, particularly the long-range types.

Aircraft in the Convair 240/340/440 series had accounted for the majority of William Wold sales in 1959, at 38 out of a total of 69 transport aircraft sold. Prices of all piston-engined transports could be expected to decline further in 1960, said Mr. Barta, and as larger business organizations bought new pressurized multi-engined equipment, older types would become available to smaller companies at lower prices, thus expanding the whole range of business aircraft operation.

The Air-freight Business

INDIVIDUAL carrier's traffic figures for 1959 are now beginning to come in and all of them are showing some fairly significant air-freight increases. Pan American, for instance, records an increase of 15% over the figure for 1958, with a ton-mileage of 116 million—nearly three times the total recorded for 1950. Over the North Atlantic the airline carried 6,310 short tons—a 24% gain. Last week the first of this carrier's converted DC-7Cs went into scheduled all-cargo service between the U.S.A. and Europe.

As an indication of increases on U.S. domestic services, American Airline's figure of 103,231,000 ton-miles was nearly 10% better than that for the previous year and the 100-million mark was being topped for the first time on scheduled services. Including express with freight Trans World's 1959 figure shows an increase of nearly 50% and this carrier's fleet of all-cargo L-1049Hs has a total potential of 6,157,000 ton-miles per month, or nearly 74 million ton-miles per annum.

Meanwhile, the September M.o.A. statistics for the two Corporations and their "associates" show scheduled-service load increases of 32% for B.E.A. and 50.6% for the associates over the figures for the same month of 1958. The total revenue cargo ton-miles performed by all U.K. operators in September was 6,589,000, or 19.2% up on the previous September figure, while the comparable figure for the associates was 1,626,000 ton-miles, or a 45% improvement.

For some time now, incidentally, Dan-Air Services has been operating B.E.A.'s daily scheduled freight services between Glasgow and London under charter with Yorks. These services call at Ringway, Manchester, on the southward journey.

Air Transport . . . .

Next Generation Prospects

New Flight-deck Features of the Airco D.H.121

SUBJECT to appropriate progress with ancillary equipment, the Airco D.H.121 should have some interesting new flight-deck and control features when it goes into service with B.E.A. in 1963.

The fact that provision will be made for the installation of equipment leading eventually to automatic bad-weather landings has already been stated, but a great deal of new thinking has also been going into the design with the object of rationalizing the flight-deck concept. Obviously the final arrangement will depend on the availability of proven flight-aid equipment to satisfy the philosophies behind the new concepts—but demand usually produces supply if the domand is sufficiently vigorous and manifestly logical.

Radical new thinking about flight-deck layout will be necessary if the next-generation transports are to be safer whilst being operated to the lower weather minima which auto-flare and, later, auto-landing will make possible. But such new thinking must not be so radical that new tricks have to be learned by the pilots. So, looking earlier this month at the 121 flight-deck mock-up, it was pleasant to see the simplification and rationalization of accepted concepts rather than any series of excessively bright new ideas.

In fact, the only sign of mildly futuristic equipment is the large pictorial navigation display in the centre panel, where it can be watched comfortably by the two (or, in the case of B.E.A., three) pilots and displacing the traditional powerplant panel. This has been moved over to the right, where it is more under the eye of the first officer, who will be the person primarily concerned with powerplant operation.

But continuous position-plotting is the primary aim of navigation; the size and prominence of the proposed display are entirely rational in relation to other equipment, and it is for the specialists to offer the means by which this ideal navigation tool can become an accomplished fact. Within three years Decca may be able to offer a Flight Log display with an undistorted chart and other navigation systems, such as Doppler, may by then include a pictorial presentation of progress in relation to airways, holding patterns and approach tracks. Whatever the equipment may be, and whatever the final form of the presentation, the right place has been reserved for it in the control cabin of the 121.

Each pilot has a flight instrument/flight director panel consisting of four primary instruments—for attitude and heading, with the appropriate director information, and for speed and altitude. These panels are supplemented by a back-to-basic group of three instruments for last-ditch emergency use. These are above the pictorial presentation and in a position where they can be seen by all the crew members. All the dials in both normal and emergency flight-instrument groups are good and big; miniaturization is reserved for the instruments which do not have to be watched or followed all the time.

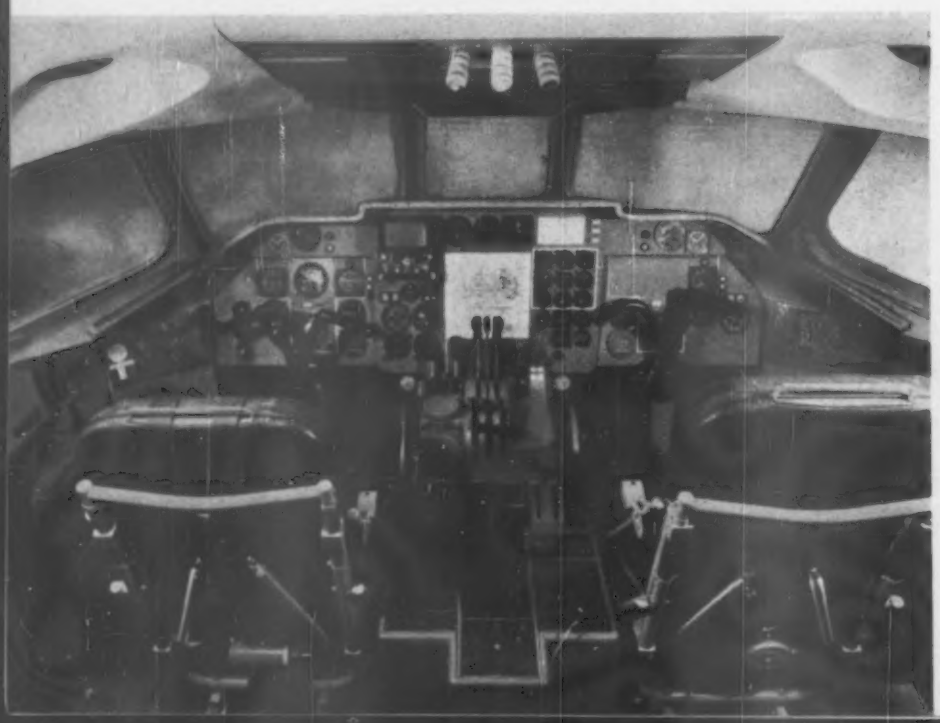
On the right of the back-to-basic flight instruments is the centralized warning system panel to which attention is directed by individual warning lights above the panels for each pilot position. These individual lights will blink red or amber according to whether immediate or eventual action is required; on the main warning panel the different red or amber lights indicate the nature of the systems or other emergency.

Nobody is likely to complain about cramped crew conditions in the 121. There is plenty of elbow room and, though the wide console (which used to be known as a "throttle pedestal") fills the gap between the seats, there is walking room between them and the fuselage walls and these outside "aisles" have been left free of equipment. Even the clumsiest of V.I.P. passengers who may be invited to "come up front," and who is waved airily into the second pilot's seat, will not find himself treading on some vital piece of equipment or hauling himself into position by means of a trimming wheel or some more vital control item.

Also under the coaming at pilots' eye-level, is another device which future development will require—an auto-landing indicator This will provide "howgozit" information about the progress of the final approach.

The programme leading towards fully automatic landings will be in two stages. The first—to be applied to the production aircraft for B.E.A.—will offer what is known as auto-flare and involves equipment philosophies which are already acceptable. On final approach there will be automatic control in pitch only, with the descent angle held constant, the speed controlled by automatic throttle operation, and the flare-out initiated by signals from a radio altimeter. The operation will be visually monitored, and lateral and directional control will be maintained manually, so duplex equipment only is involved. The

(*Continued on page 99*)



PATTERN FOR THE FUTURE?—The flight deck mock-up of the Airco D.H. 121. A forward-looking feature is the centrally placed pictorial navigation panel, with a "back-to-basic" flight-instrument group above it. The powerplant panel is on its right and above this is the emergency indicator panel. At the captain's position can be seen a developed flight instrument/director group which will be duplicated in the first officer's panel which was incomplete when this photograph was taken.

THINK of an airfield—

Think of an out-of-the-way airfield anywhere up on the hillside or out in the plain. String on a half-dozen others in a regular rough-and-tumble route for a modern 47-seat aircraft. Now consider their short, unmetalled runways that defy all but one of the new jet-prop transports.

Throw in a mixed traffic of passengers and freight. Assume (correctly) that your fare-payers want increasingly smooth, sophisticated flight and that your freight needs speedy, easy handling.

Add it all up, take away the plodding old piston-engined veteran you first thought of, and you *must* have—

The Rolls-Royce engined HANDLEY PAGE DART

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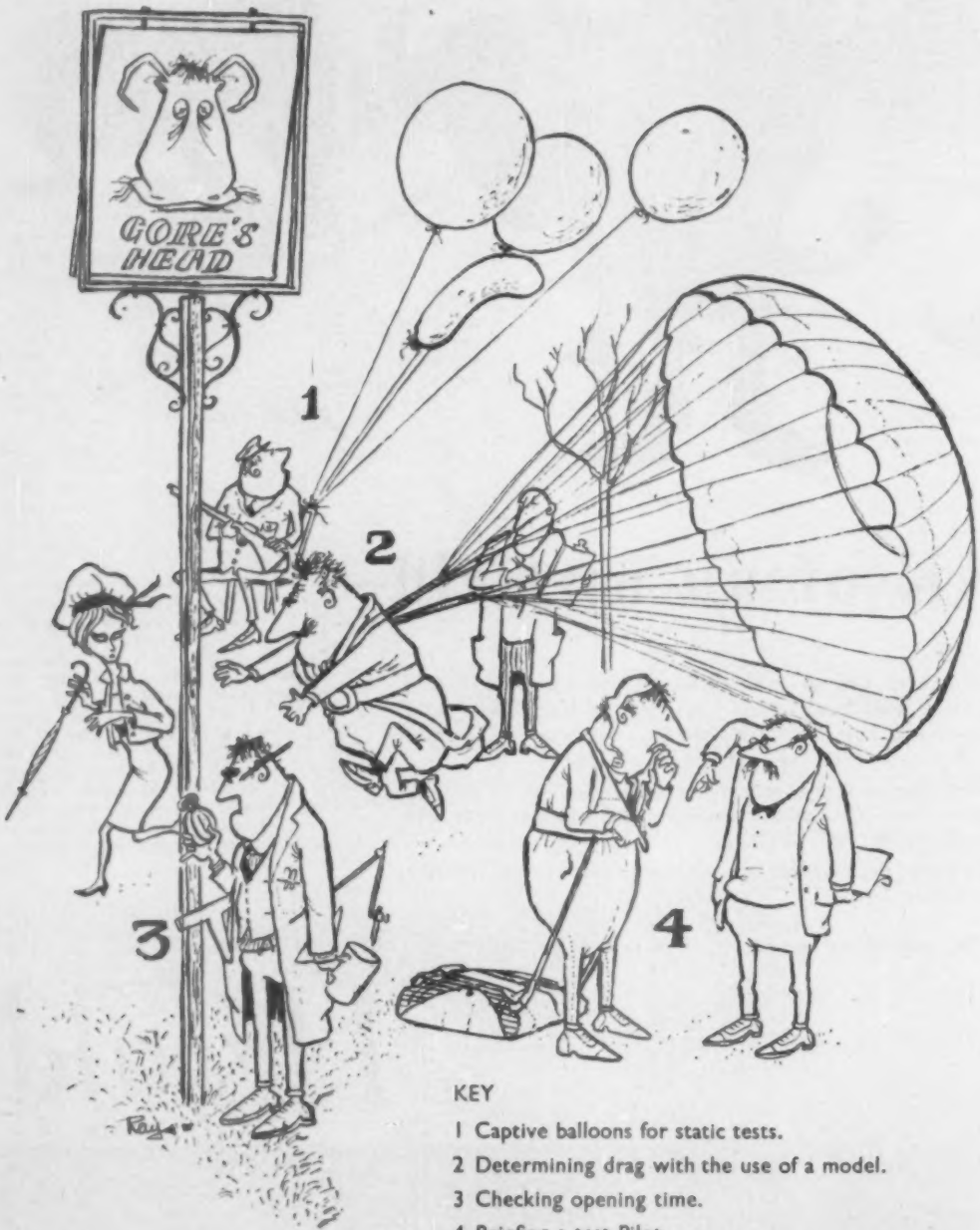
Parachutests I



KEY

1 Captive balloons for static tests.
2 Determining drag with the use of a model.
3 Checking opening time.
4 Briefing a test Pilot.

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Air Transport . . . .

(*Continued from page 98*)

two autopilot sub-systems will be automatically disconnected if there are any differences in their performances.

The objects in providing auto-flare are those of making an essential start towards the development of auto-landing and of helping the pilot in the final few seconds before touch-down without taking away any of his overriding control of the situation. The system is likely to reduce the number of overshoots by making the operation more reliable in normal service while using acceptable present-day weather minima. Experience may permit some gradual reductions in these minima, with consequent improvements in day-to-day operating regularity.

Fully automatic landings may come later. These will involve a much greater degree of automaticity and, since the aircraft may be committed to a landing in non-visual conditions, the development of multiplex equipment of unquestionable integrity if the pilots (and passengers) are to accept it. The acceptable minimum will be triplication of essential automatics and systems, and the assumption that everything is in working order when a decision is made to complete an approach and landing rather than to divert. A higher degree of multiplication may turn out to be unacceptable to operators in terms of expense and weight in return for a reduction in the number of diversions. It cannot be expected that airport authorities will be able to provide expensive leader-cable approach guidance for all instrument runways, so it is probable that the development of automatic landings will follow improvements in the accuracy of ILS guidance, with leader-cables used, perhaps, for guidance only during the final part of the approach, the flare-out and the landing run.

The Airco D.H.121 is an "uncompromised" short-range transport designed for operations over stages up to, say, 1,200 st. miles, but it has certain natural stretch-capabilities for customers who need to fly longer non-stop stage-distances. This range stretch will be at the expense of increased gross weight (to about 112,000 lb.) and with total take-off distances increased from the normal 6,000 ft. to, say, 6,700 ft. in I.S.A. at sea level. Carriers who wish to use the 121 for longer-haul operations are not likely to be runway-restricted (or not, at least, in the U.S.A., where the demand might arise) and the sacrifice of take-off performance is reasonable enough. The extra fuel will be carried in the centre-section; normal fuel is in four integral wing tanks. The 121 has been designed with a landing weight (100,000 lb.) which is 95% of the take-off weight, so that non-refuelling intermediate traffic stops can be made.

The three-engined layout of the 121 fits in well with a "triplex" system philosophy for electrics and hydraulics. The systems are further supplemented by an optional A.P.U. (used for electrical and starting supply where ground power is not available) and by an electric hydraulic pump and a retractable air-driven turbine for final emergency power.

Development and production plans for the 121 include flight of the first 121 in December next year and the use of seven production aircraft for development and certification flying. These will come off the lines during 1962 and will enter the delivery sequence later. Certification is expected in 15-18 months after initial flight and the first six aircraft for B.E.A. will be delivered by mid-1963 with the other batches, of 12 and six, for the Corporation coming off the lines at later intervals. Given orders, a production rate of six per month is planned, with the prospect that 100 aircraft may be completed by about the end of 1964.

J.A.L. Seeks New Equipment

JAPAN AIR LINES plans to start operations on two routes between Tokyo and European cities (including London) next year. One will be a polar route, flown by DC-8s, and the other will be a "southern" route through the Middle East and India. A medium-range jet aircraft is required for this latter operation and a survey team from the airline is shortly to visit manufacturers in the U.S., U.K. and France to examine possible equipment

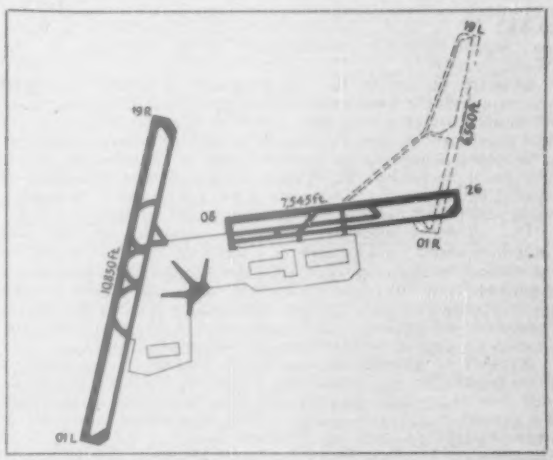
The southern route could be operated initially by DC-7Cs already in the J.A.L. fleet. If the airline decides, on the other hand, to use new equipment from the outset and is determined to start operations in 1961, the choice seems to lie between the de Havilland Comet, the Boeing 720 and the Convair 880/600.

Deliveries of the DC-8 will begin on June 1 and the airline will introduce this aircraft on its trans-Pacific routes in July. The fifth DC-8 (four P. & W. JT4A-9) which, as announced last week, J.A.L. has now decided to order, will be delivered in May, 1961, and the Polar route to Europe will be opened as soon as possible after that date. With five DC-8s in service, Japan Air Lines plans to operate nine flights a week on its trans-Pacific network, plus two Tokyo-Hong Kong services and two Tokyo-Europe services each week.

Progress at Arlanda

STOCKHOLM'S new international airport at Arlanda was partially opened on December 14, as reported in our issue for December 25. On that day, Mr. Gösta Skoglund, Swedish Minister of Communications, flew to Arlanda in an S.A.S Caravelle to inaugurate the new main 10,830 ft. runway. The airport is now being used by S.A.S. for crew training on its Caravelles,

The 90 ft. high radar tower at Arlanda for the new Decca surveillance system.



which will be joined, in the near future, by the airline's DC-8s. Passengers will not use Arlanda until April, when the DC-8 goes into service with S.A.S. on its North Atlantic and Polar routes.

Further development of the airport, by 1963, will include a second runway (01R/19L, 6,560 ft.) and a high-speed motorway link with Stockholm, 25 miles to the south. The new 01L-19R runway is 230 ft. wide, including a 40 ft. asphalt strip down each side of the 150 ft. central concrete strip. There is, in addition, the older 7,545 ft. 08/26 runway, which was put down when development of the site started under the name of Halmsjöen, but was later abandoned.

Buildings completed so far include the first stage of a massive maintenance hangar for S.A.S., to house four aircraft of DC-8 size. This 300 ft. long building (only half the final size) comprises a central multi-storey structure with cantilevered roofs on each side.

Also complete is the runway lighting installation, central heating and water system supply plant and the radar installation. The radar is Decca D.A.S.R.1, a new airfield surveillance system for areas of medium to high density traffic at altitudes up to 40,000 ft. It has a range of more than 100 miles, working in the 10 cm. band, and is the first installation of its kind at a civil airport. The two reflector aerials are mounted back-to-back on top of a 90 ft. high cylindrical concrete tower.

The main terminal building for Arlanda, which is to be capable of handling 1,200,000 passengers a year by 1963, is now in the stages of final design. Until it comes into use, a temporary terminal is being provided in a large converted garage.

The Fighting Services

A.O.C. Hong Kong

AIR COMMODORE P. L. DONKIN, C.B.E., D.S.O., has been appointed Air Officer Commanding, R.A.F. Hong Kong. Completing the 1959 Imperial Defence College course, Air Cdre. Donkin was previously Assistant Chief of Staff (Intelligence) at Headquarters, Allied Air Forces Central Europe. In 1954 he became Air Attaché in Moscow.

Lecturing in North America

THREE senior R.A.F. officers are shortly leaving the United Kingdom to lecture to members of the U.S.A.F. and R.C.A.F. Altogether, a total of six lectures will be presented to students of the U.S.A.F. Air War College at Maxwell Air Force Base, Alabama, and the R.C.A.F. Staff College, Toronto.

Air Marshal H. D. McGregor, A.O.C.-in-C., Fighter Command, is to speak on the subject of "The Defence of the United Kingdom," and a paper entitled "A British View of Allied Strategy for Cold War, Limited War and General War," will be presented by the Commandant of the Joint Services Staff College, Air Vice-Marshal Sir Laurence F. Sinclair. "The offensive capabilities and employment of Bomber Command" is the title of two lectures to be given by Air Vice-Marshal T. A. B. Parselle, Senior Air Staff Officer, Bomber Command.

Commando Carrier

EARLIER this week H.M.S. "Bulwark" was due to be commissioned at Portsmouth as the Royal Navy's first commando carrier. Commanded by Capt. R. D. Franks, D.S.O., O.B.E., D.S.C., R.N., she is to sail to the Far East to be based on Singapore after working-up at home and in the Mediterranean.

Basically the carrier has not been altered during her recent refit although the fixed-wing aircraft equipment, such as arrester wires and catapults have been removed. Various other changes and modifications have been made to make the ship suitable as a helicopter/troop carrier equipped with 16 Whirlwinds, which will be replaced by the Wessex when the new helicopter is available. She has retained her guns, radio and radar equipment and is still capable of directing fighter aircraft.

The carrier's helicopter force is provided by No. 848 Squadron under the command of Lieut. Cdr. B. M. Tobey, R.N. At present working-up at Worthy Down, the Squadron has a complement of 180 officers and other ranks. Originally formed as an Avenger torpedo-bomber squadron in the Second World War, No. 848 became a helicopter unit in 1953 and for four years took part in anti-terrorist operations in Malaya.

As well as undertaking the initial landing of the carrier's Commando (No. 42 Commando, Royal Marines), the Squadron will operate tactically in the field. The helicopters will provide the ground forces with a high degree of mobility, especially in open warfare or light operations.

In addition to its permanent Commando of about 600 officers and men and their equipment, "Bulwark" is capable of embarking an additional Commando or any Army unit of equivalent size for short periods.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. C. G. Reeve, M.B.E., to the Department of the Air Member for Personnel.

Bomber Command: Gp. Capt. A. D. Mitchell, D.F.C., A.F.C., to R.A.F. Cottesmore to command; Wg. Cdr. A. B. Goldie to R.A.F. Brize Norton for liaison duties; Wg. Cdr. R. T. Bainbridge, A.F.C., to command the Joint Air Reconnaissance Intelligence Centre.

Fighter Command: Wg. Cdr. J. A. Wilson, O.B.E., M.A., to Headquarters for education staff duties; Wg. Cdr. R. D. Williams, O.B.E., to the school of Land/Air Warfare, for duty with the Transport Support Wing; Wg. Cdr. R. C. Brown to Headquarters Air Traffic Services for regional policy and planning duties.

Maintenance Command: Wg. Cdr. A. B. Thomas to Headquarters for equipment staff duties.

R.A.F. Germany: Gp. Capt. S. G. Wise, C.B.E., D.F.C., to be Chief of Staff, No. 2 Tactical Operations Centre, NATO.

Middle East Air Force: Wg. Cdr. G. J. C. Hogan, D.F.C., to R.A.F. Akrotiri to command the flying wing.

Far East Air Force: Wg. Cdr. G. K. Birch to Headquarters for joint planning staff duties.

British Forces Arabian Peninsula: Wg. Cdr. G. P. Howell, O.B.E., to No. 114 Maintenance Unit Aden, to command.

Other Appointments: Wg. Cdr. P. G. M. Ridsdale to the United States for administrative planning duties with NATO; Wg. Cdr. C. R. Alexander, M.B.E., A.F.C., D.F.M., to Australia to command the R.A.F. Support Unit; Wg. Cdr. R. J. Lewis to the Ministry of Defence; Wg. Cdr. E. H. King to SHAPE for Tripartite Planning Staff Duties; Wg. Cdr. P. J. Cundy, D.S.O., D.F.C., A.F.C., to the Home Fleet as Staff Officer to the Commander-in-Chief; Wg. Cdr. D. A. Oxby, D.S.O., D.F.C., D.F.M., to the Joint Services Staff College for directing staff duties.

More Service News

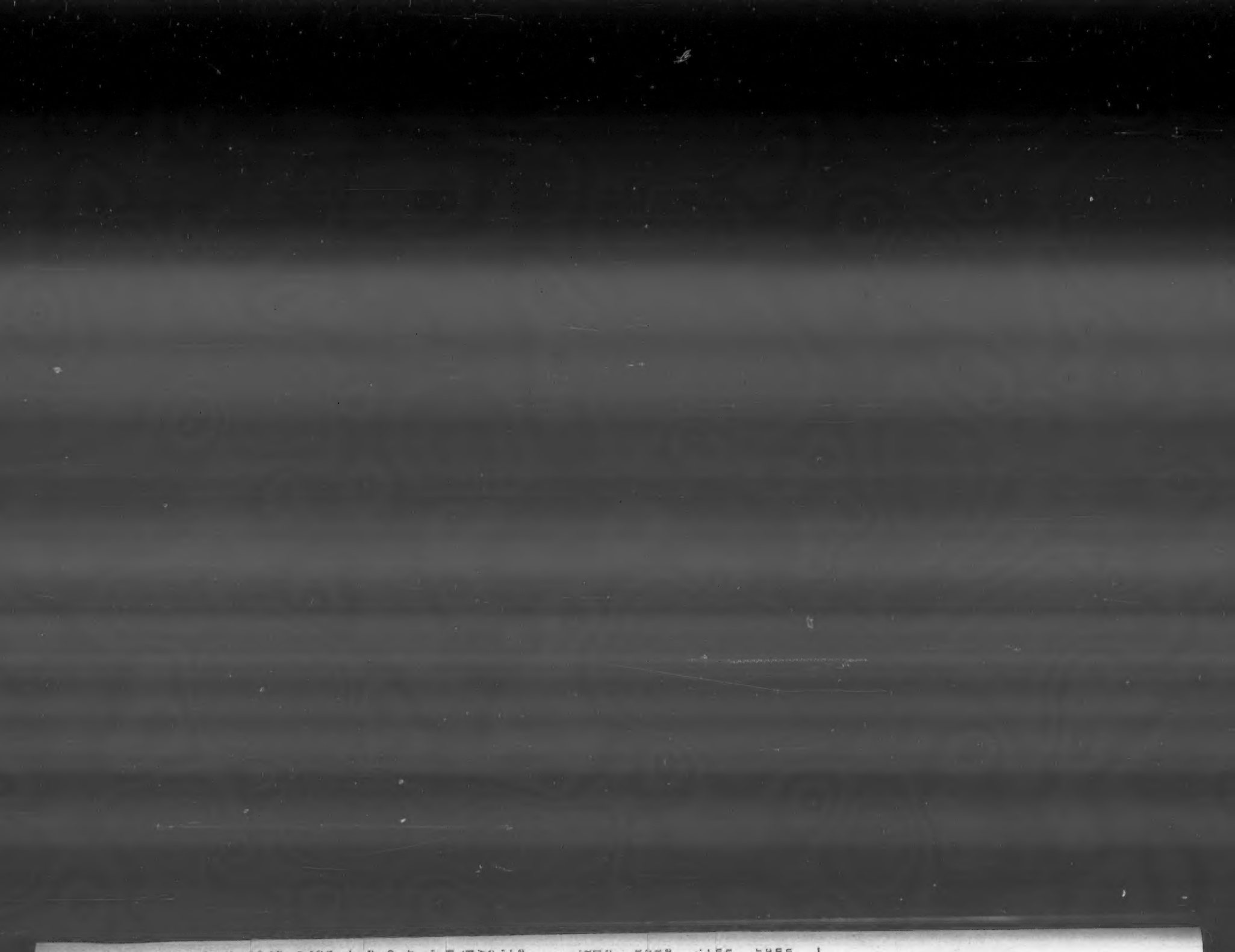
AUSTRALIAN JOINT STAFF.—Air Vice-Marshal A. M. Murdoch, C.B., C.B.E., R.A.A.F., Head of the Australian Joint Services Staff in London, has succeeded Air Cdre. D. W. Kingwell as R.A.A.F. Representative, London, and will now hold the combined appointment.

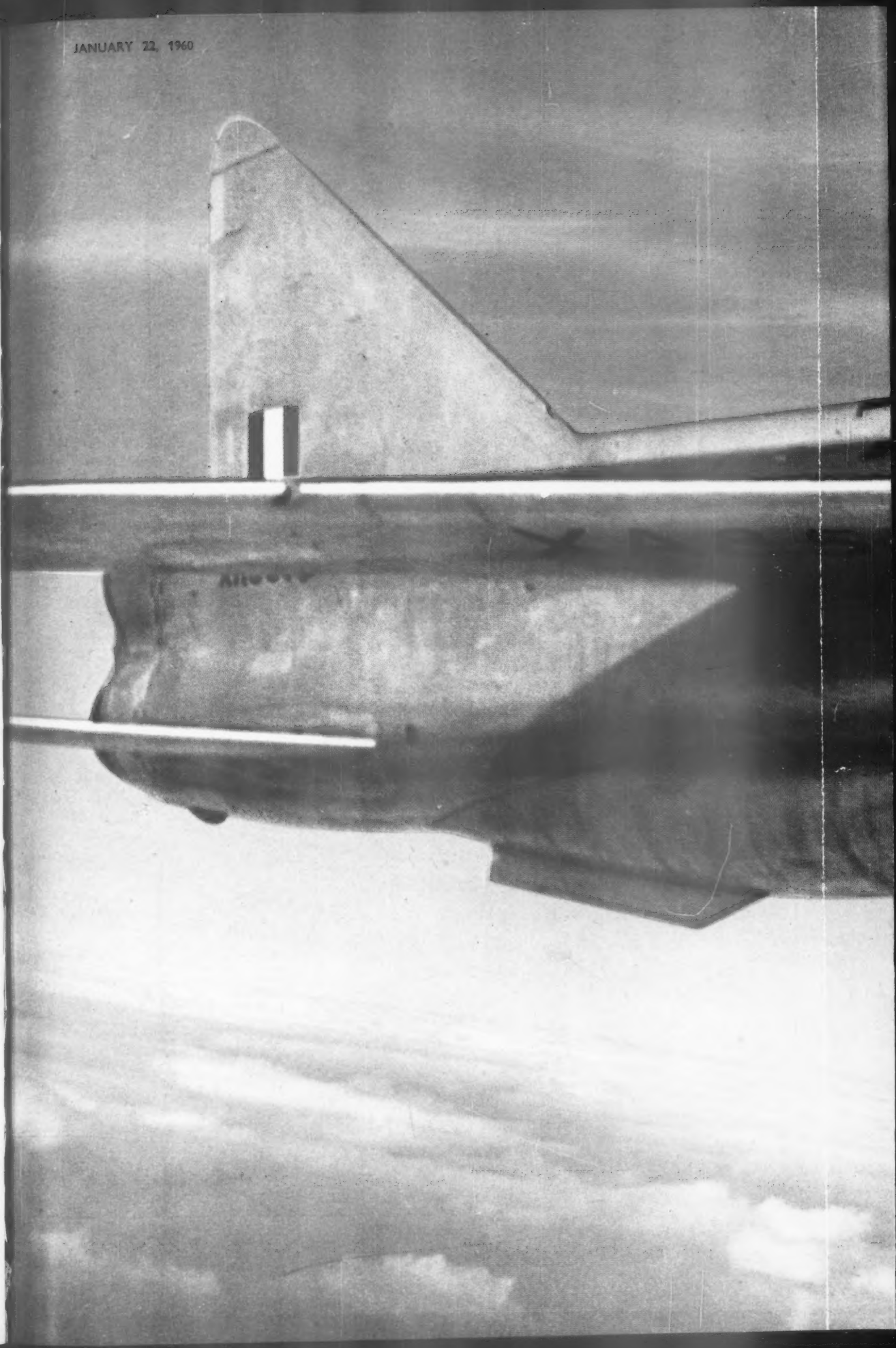
R.A.F. PLYMOUTH.—The Coastal Command Marine Craft Efficiency Competition has been won for 1958-59 by the Marine Craft Section of the Marine Craft Training School at R.A.F. Mount Batten, Plymouth. The runners-up, as in the previous year, were the Marine Craft Section at R.A.F.. North Front, Gibraltar.

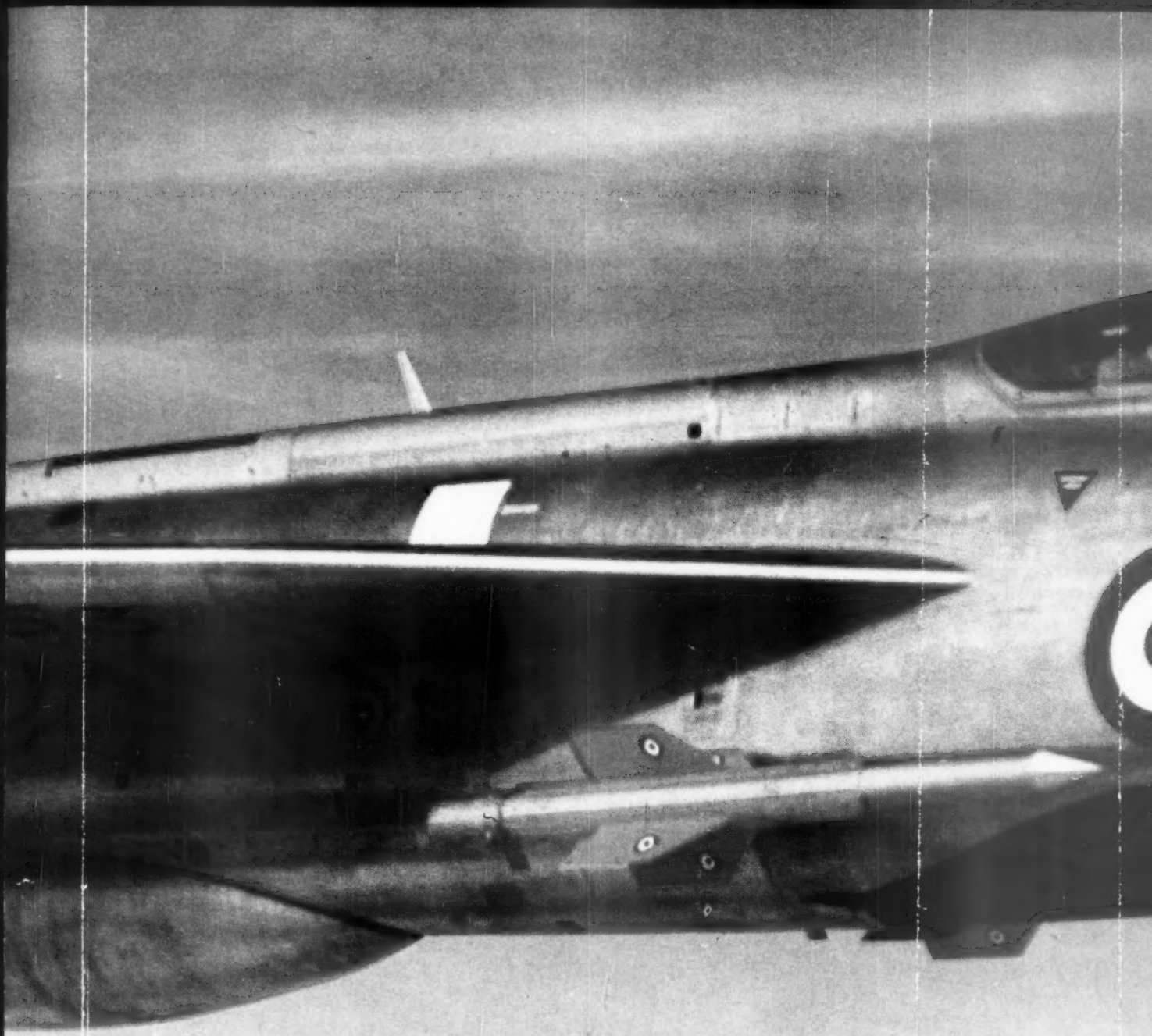
F.E.A.F. RECONNAISSANCE.—No. 81 Squadron (Sqn. Ldr. R. J. Linford) at R.A.F. Tengah recently logged its 10,000th reconnaissance and photographic sortie in the Far East. Operating within the Command since 1946, the Squadron is at present equipped with Meteor PR.10s.

R.C.A.F. AWARD.—The largest award ever granted to a member of the R.C.A.F. by the Suggestion Award Board of the Public Service of Canada has been made to Flt. Lt. R. R. Sly at Canadian Air Force Headquarters. Worth $1,253.75, it is for his suggestion concerning the lighting for R/T channel changing in CF-100s.

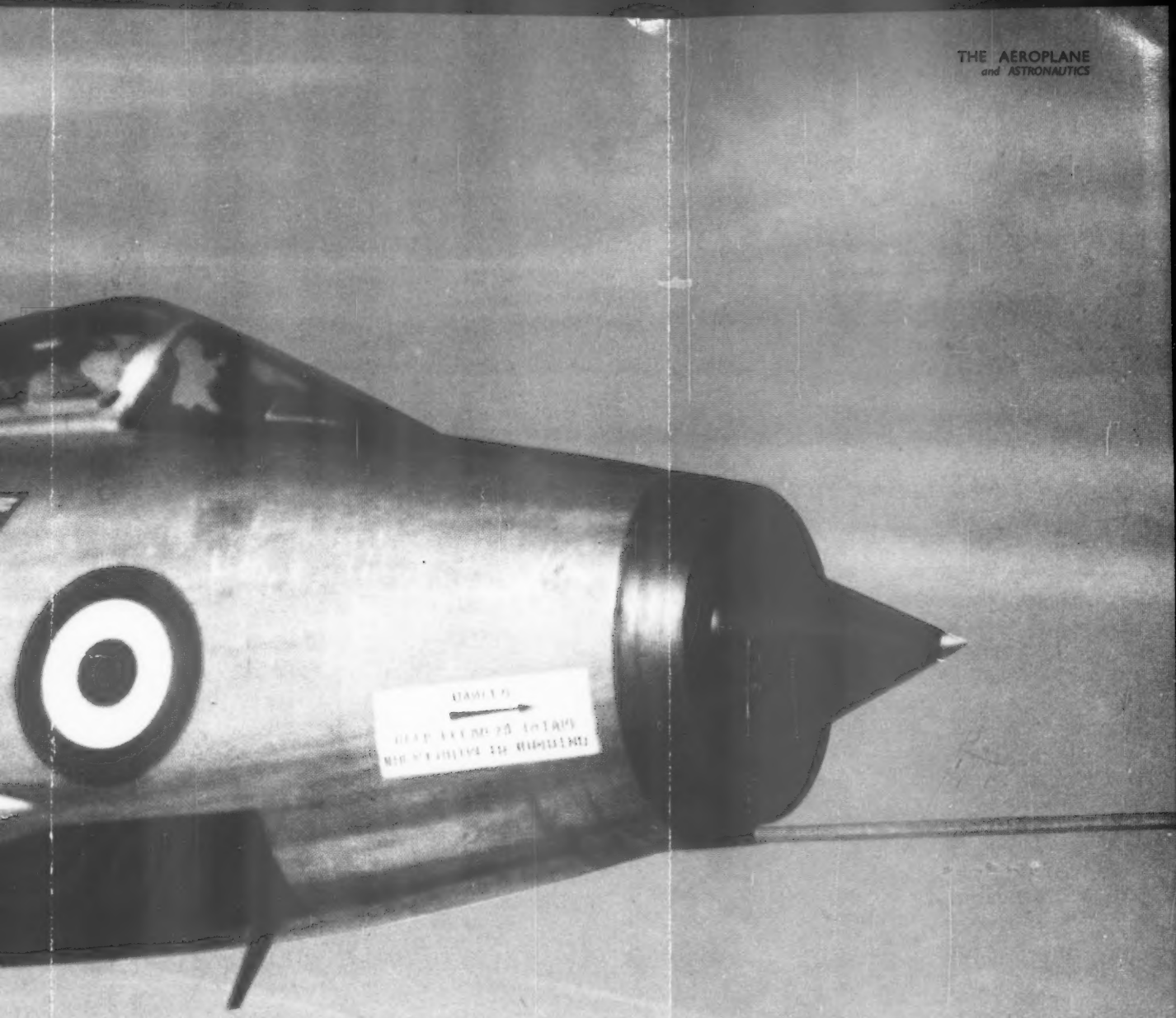
LYNEHAM TYPES.—A typical present-day scene at R.A.F. Lyneham. The Transport Command long-range force at the station now comprises two Britannia C.1 squadrons—Nos. 99 and 511—in addition to No. 216 Squadron equipped with Comet 2s.







...the incomparable



le 'ENGLISH ELECTRIC' *Lightning*

What NATO needs—th

WIDE SPEED RANGE

Designed to give high-level supersonic performance as a fully integrated weapon system, the Lightning has a top speed in excess of Mach 2 yet is completely controllable over a speed range greater than thirteen to one. It loses none of its outstanding flying characteristics in subsonic or transonic flight.

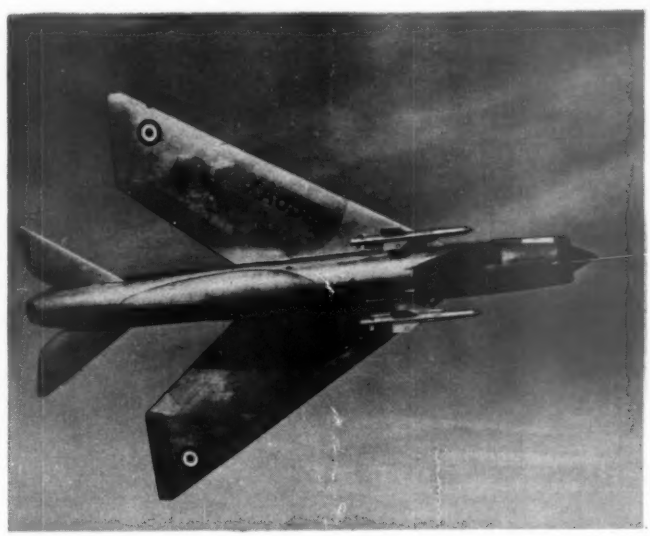
ALL-WEATHER OPERATION

The Lightning has been designed as an all-weather day or night interceptor. Its comprehensive instrumentation, versatility and superb flying qualities enable it to fulfil its role safely and efficiently under all climatic conditions.

OUTSTANDING PERFORMANCE

The Lightning reaches a speed of Mach 0.9 in level flight at operational height within 2.5 minutes from brake release. In considerably less than 3.5 minutes it can accelerate from the speed of sound to Mach 2.

At all altitudes the Lightning is highly manoeuvrable and fully aerobatic whether subsonic or supersonic; such outstanding performance makes the aircraft suitable for a number of roles including Ground Attack and Photo-reconnaissance.

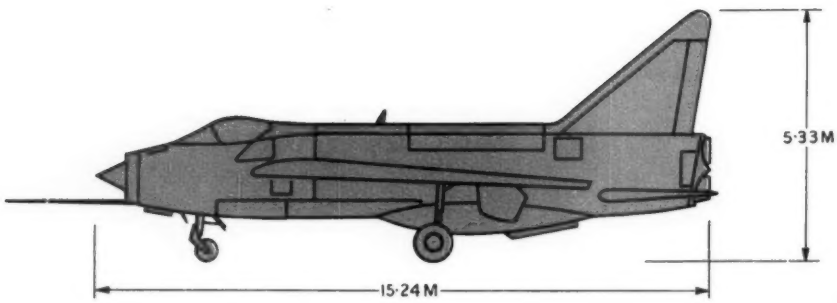


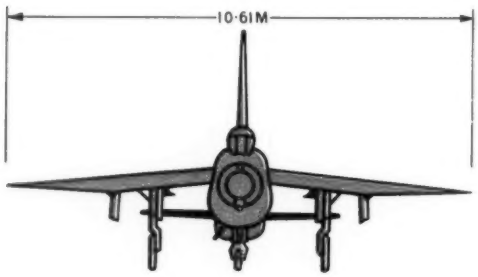
—the Lightning has . . . . *Now*

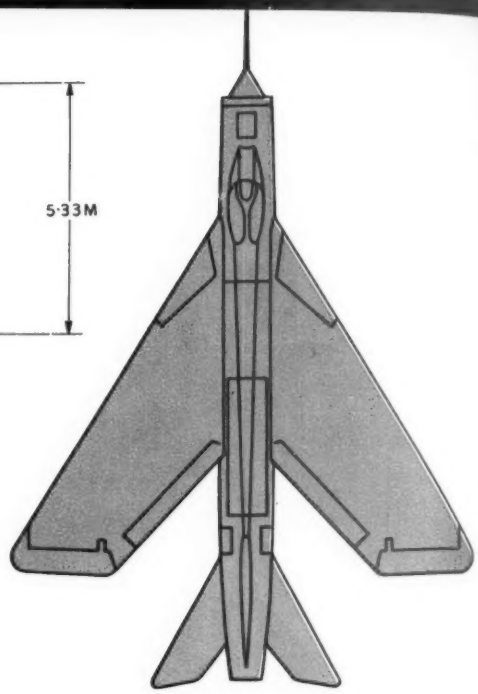
Two-seat version now available

The two-seat version of the Lightning now available has all the outstanding qualities of the single seat version and a comparable performance. It can be used as a trainer, for conversion purposes, or as an operational aircraft . . . or the same aircraft can fulfil all these functions.

In its operational role the pilot can give full attention to

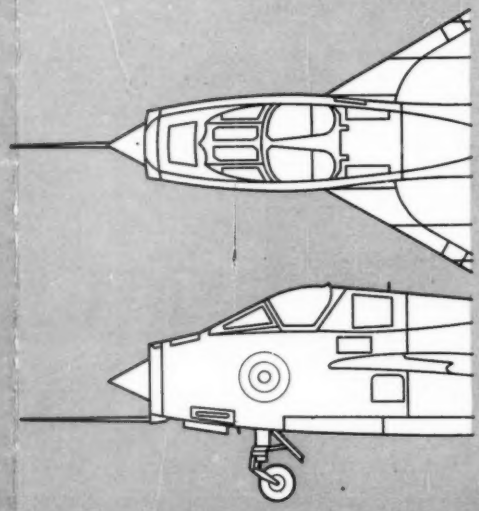






his instruments while the radar operator takes over fire control responsibilities.

The two-seat Lightning is equipped with the same full navigational and landing aids, airborne search and track radar as are fitted to the single seat version. All controls and instruments including Radar Fire Control are duplicated.



AN INTEGRATED WEAPON SYSTEM

The engines, airframe, radar equipment, the electronic aids, the armament, the fire control devices—all were planned from the start to work as a co-ordinated whole to achieve maximum operational performance.

A variety of armaments can be fitted to meet different operational requirements—all are developed within this integrated weapons concept.

INHERENT AERODYNAMIC STABILITY

Ease of control at all speeds is achieved without autostabilisation; the Lightning does not depend upon electronically supplied stability. Auto-stabilisation is there—but needed only as a refinement in the tracking and attack phases.

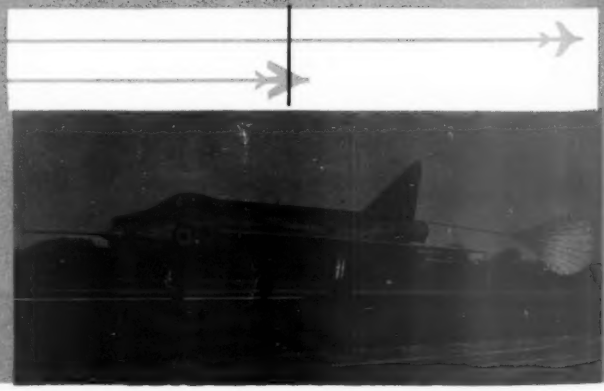
All this has been achieved because the design of the aircraft is such that it is inherently aerodynamically stable and completely free from pitch-up throughout its entire performance range.

DEVELOPMENT POTENTIAL

The Lightning is only at the start of its great potential. This basic design offers great possibilities not only for increased performance but also for adaptation to other roles. This potential ensures great economies in operation.

EASE OF LANDING

No complicated landing techniques need be learned nor any extensive runway alterations made, for the Lightning can be landed and brought to rest in 800 yards.



English Electric Aviation Limited Marconi House Strand London WC2

Latin-American Survey

By Comet to Santiago

ON January 25 a party of distinguished personages, at the head of which is expected to be Mr. Duncan Sandys, the British Minister of Aviation, will leave London Airport in a Comet of the British Overseas Airways Corporation. With Mr. Sandys, who is to be accompanied by his daughter, will be H.E. the Brazilian Ambassador in London, Senhor Francisco de Assis Chateaubriand, Sir Gerard d'Erlanger, chairman of B.O.A.C. and Lady d'Erlanger, the Viscount Davidson, president of the Hispanic and Luso-Brazilian Council, Lord Bridges, chairman of the British Council, and Lady Bridges, Sir Aubrey Burke, president of the Society of British Aircraft Constructors, and Lady Burke. In São Paulo the party is to be joined by Mr. Basil Smallpeice, the managing director of B.O.A.C., and Mrs. Smallpeice. Some 26 hours later Mr. Sandys and his party will alight at Santiago de Chile.

The flight will mark the reinauguration of the air link between London and South America, opened on January 1, 1946, by the British South American Airways Corporation, which was taken over by B.O.A.C. in 1949. In those days the service took 77 hours, though within three months the time to Buenos Aires had been cut to 56 hours, with a night-stop at Rio on the second night. Leaving London at noon, the traveller was in Montevideo on the third day at 16.40 local time. At that time today's present intense competition had hardly begun. Panair do Brasil was just about to inaugurate its service. It was in 1954 that, owing to shortage of aircraft, B.O.A.C. had to suspend its twice-weekly service by the four-engined Argonauts, always so well filled at the peak seasons.

The new service, now opening with turbojet aircraft, has cut the times sensationally. Today passengers leave

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Latin-American Survey . . . .

SOARING ASPIRATIONS.—A new skyscraper towering over older buildings in Recife parallels the memorial to Captain Sacadura Cabral, pilot, and Vice-Admiral Gago Coutinho, navigator, who crossed the South Atlantic by air in 1922 in a Fairey seaplane. (1)

The first South American city seen by the traveller from London is Recife. Even at night, from an altitude of a dozen kilometres, as the southward flying traveller first perceives it, the city in its encircling rivers and waterways seems like some fairyland Venice bespangled with light. If the voyager southwards were to have time to explore the waterfront of this busy port over which the warm trade winds blow so refreshingly, he or she would find a memorial to a very early joint Portuguese-English endeavour. In the year 1922 the South Atlantic was crossed for the first time by air. The pilot, Captain Sacadura Cabral, and his navigator, Vice-Admiral Gago Coutinho, both of the Portuguese Navy, flew a Fairey IIID seaplane with a 360 h.p. Rolls-Royce engine.

If our visitor to Brazil knows anything about aviation at all he (or she) will need no reminding of that wonderful Brazilian, Alberto Santos-Dumont who was flying his own airship single-handed round the Eiffel Tower in Paris in 1901. Only five years later he was flying his own aeroplane. Indeed, to him must go the credit, in 1906, for the first sustained flight in Europe in an aeroplane. To a man of such vision, the comfort and safety in which the fortunate passengers in B.O.A.C. Comets eat and sleep so many kilometres above the ocean would occasion no surprise.

It is not the place here to enlarge upon the vast potentialities of the wonderful country of Brazil, with its area of 3,289,000 sq. miles and population of 63,102,000. A measure of its size and the benefits conferred by super-swift air travel such as that provided by the Comets of B.O.A.C. becomes apparent on the next stage on the new service to São Paulo, which is nearly as far from Recife as is Dakar.

It is just as noticeable taking off from the runway at Recife, as it is from that at Dakar, how swiftly the laden Comet pulls off into the air. It is always off the ground halfway down the runway and it takes about 30 seconds to get into the air. A silent effortless climb leaves the ground far behind. Within minutes of taking off, passengers in the vibrationless cabin find themselves poised in space high over everything, with clouds far below.

São Paulo, as we have just said, marks the next stage of the service and, as is widely known, this thriving expanding exciting city is the capital of the great Brazilian state of São Paulo. It is as big as Rio de Janeiro and if it does not have the

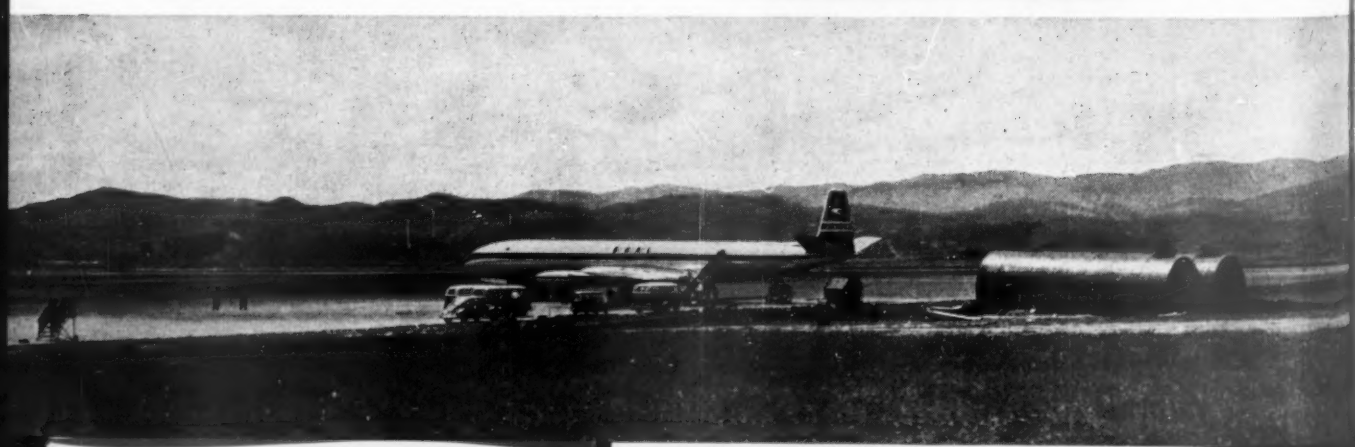
England at 18.15 in the evening (GMT) and are in Recife at 05.25 local time next day. Less than four hours later they are in São Paulo. Two-and-a-half hours' flying takes them to Montevideo. Half-an-hour to Buenos Aires. Over the Andes to Santiago is just over two hours' flying. The fortunate passengers on the inaugural trip from the United Kingdom will thus pass from the rigours of an English winter to the splendid sunshine of a South American summer, in not much more than a day.

The opening of the South American service will mean that B.O.A.C. will have successfully completed the introduction of Comet services to three continents within three months. The Australian service started in November. That to South Africa a week later. With the new service the Corporation has adopted a policy of employing South American girls as stewardesses. They were specially chosen by selection boards who visited the countries along the route, and the girls were then trained by B.O.A.C. in London.

The opening of the new service with its collecting points at London, Madrid and Lisbon in Europe and the important centres at São Paulo, Montevideo, Buenos Aires and Santiago provides travellers wishing to cross the South Atlantic with the speediest and most comfortable form of transport available. Cruising at 800 kilometres an hour, the superlatively comfortable and noise-free Comets of B.O.A.C. cover the route in convenient stages of about 4½ hours' flying time. These performances have, of course, been brilliantly demonstrated by the Comet services of Aerolineas Argentinas, which not only provide the transatlantic link between the old and new worlds but also operate services down the whole East coast of South America.

Colonel Faria Lima, the commandant at Cumbica, talks with Paul Vaillant of B.O.A.C. (2)

A Comet 4 of B.O.A.C. being refuelled at Cumbica airfield, near São Paulo, during a proving flight. (3)



Right, the fine airport building at Ezeiza airfield, Buenos Aires, has a swimming pool in front of it. (4)

Below, B.O.A.C. staff at Montevideo lined up as the Comet taxis out for take-off. (5)

breath-taking beauty of great sweeps of sea and mountains which give Rio de Janeiro its characteristic setting, São Paulo has a vitality and energy all its own. A fine new airport is being built at Vira Copos some 50 miles outside the town. Meanwhile the Comets of B.O.A.C. are using the runway at the military airfield at Cumbica under the command of Colonel Faria Lima.

Unfortunately at Rio de Janeiro the runway at Galeao not only has an inadequate surface for jet operation, but it is being lengthened to accommodate those jets which require much longer runways than does the Comet. Thus at present, it is not possible for the Comet to be operated from the airfield while these improvements are in hand. Consequently, it will be some months before the B.O.A.C. service operates in and out of Rio de Janeiro.

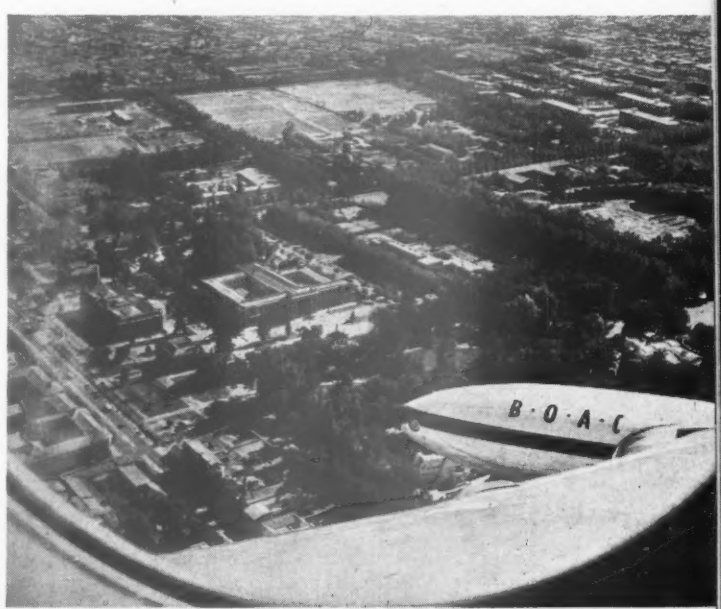
It is an interesting fact that some 30% of the traffic across the Atlantic between South America and Europe is generated in Brazil. The opening up of the B.O.A.C. air link with São Paulo may well lead to a situation where it will become necessary to maintain the British air link with São Paulo as well as with Rio. If so, the increased traffic brought about will be to the mutual benefit of all. As the traveller speeds over the vast spaces of the fertile country of Brazil, the potentialities of aeronautical development seem illimitable.

From São Paulo the service carries on to Montevideo and here the English traveller will be fascinated by the resemblance of the vegetation and scenery to that in his own country. As a capital city, Montevideo has the wonderful advantage of being situated along the most delightful and accessible beaches. Its fortunate inhabitants can walk straight out of their pleasant houses onto white sand and into the gleaming waves.

From here the service carries the traveller swiftly up into the stratosphere and drops him down again after flying above the great River Plate into Buenos Aires. Flying over this river, the aeronautically inclined traveller cannot but muse on the fact that the cities of Buenos Aires and Montevideo are remarkable for a city-centre to city-centre air service operated by flying-boats, and British flying-boats at that—Short Sandringhams. The journey takes an hour and runs at intervals of two and a half hours.

From the splendid airfield and buildings of the Argentine international airport at Ezeiza the Comet carries its 63 passengers over the vast areas of the Argentine pampas and quite suddenly under the aircraft are the wonderful jagged masses of the Andes and towering above the whole the snow-sugared cone of Aconcagua, 7,100 metres high. The 200-mile belt of these vast mountains which proved such a hazardous barrier to the heroic pilots of the Aeropostale service of nearly 30 years back lies open under the eyes of the traveller who from his apparently motionless aircraft, can study the entire formation. In moments the Comet has reached the Pacific side, the streams in the valleys have grown to huge rivers and, dominating its well-cultivated plain of chequer-board fields and poplar-marked streams, lies Santiago, the end of the journey and within 60 miles of the Pacific. A day away lies London.

We do not propose to deal in this article with the remarkable product of British aeronautical engineering which has made it possible for B.O.A.C. to provide this service. Particulars of the performance and capabilities of the Comet are dealt with elsewhere. These two latter articles, in combination with the preceding account, and also the review immediately following of what the Industry has to offer, form a complete supplement in themselves under the title "Latin-American Survey."



JOURNEY'S END.—How Santiago looks to a traveller in the Comet after flying from London in 26 hours. (6)

Photographs copyright "The Aeroplane and Astronautics"

Latin-American Survey . . . .

For the Latin-American

A review of British aircraft and aero-engines

GREAT BRITAIN has been exporting aeroplanes to Latin America for nearly 40 years, and she still enjoys the lion's share of the available aircraft business that goes to non-dollar countries. Before the War, her exports were mainly of a military character; now they include military and civil types.

The growing interest being shown in British civil aircraft by Latin America has a significance that may not at first be apparent. Recent purchases of Vickers Viscount and Bristol Britannia turboprop airliners and of de Havilland Comet jet airliners can, in fact, be interpreted as a recognition of the British aircraft industry's new status.

From the early 1930s until the late 1940s, the United States led the World in the design and production of civil airliners, and U.S. airliners were, in consequence, the first choice of most countries that did not build their own—and of some that did. British airliners, before the War, were designed to meet the needs of British air services and to conform to Government air policies. These needs and policies were not common to other countries, and the demand for the airliners built to meet them lacked the performance and characteristics sought by the generality of international operators.

After the War, Great Britain gambled millions of pounds in an effort to win at least a position of parity with the United States as a supplier of equipment for the World's airlines. She chose as the instruments of her ambition the turbojet and turboprop aero-engines. Neither source of power could, at that time, be said to have emerged from the experimental stage, and when Britain's resolve became known, loud and almost universal misgivings were expressed.

But the gamble came off. From the several enterprises embarked upon there emerged two airliners of outstanding merit. These were followed, after a short interval, by another—and the trio gave Britain such a commanding lead in the application of turbo-engine power to civil aircraft that all competitors were left far behind.

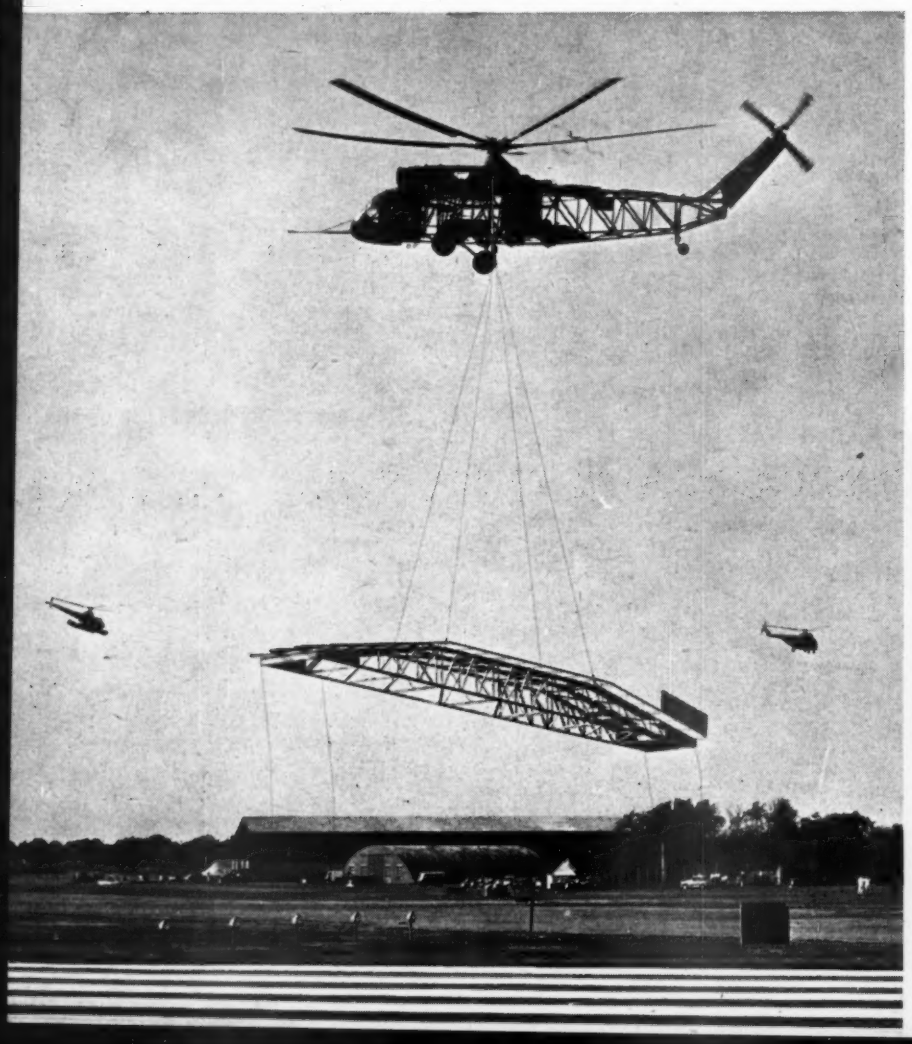
Today, the United Kingdom has second-generation types flying, and their designs embody all the lessons learned in the millions of airline flying hours amassed by the first generation. The fund of experience upon which they are based was collected in operations on the air routes of almost every country in the World. Meanwhile, competitive aircraft have but recently started their airline careers.

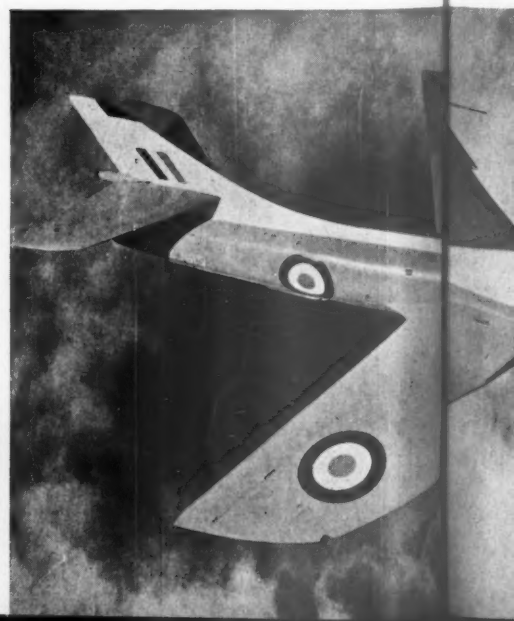
Latin America's purchases gain additional substance when it is remembered that the United States buys more from Latin American countries than any other country in the World. Conversely, because of this, the Latin American countries buy largely from the United States. They command resources in dollars far greater than in other currencies.

From these facts, only one conclusion can be drawn; airliners with the performance and characteristics of the Viscount, Britannia and Comet could not be bought within the dollar area, or the orders would not have come to Britain.

The Expanding Range

The Viscount, Comet and Britannia are the trio with which Britain's leadership in the new realm of aircraft engineering was established. Four more civil types with turbo-engines have lately been added to the catalogue, and the range now embraces every class of commercial aircraft to which this type of engine is applicable, with one exception—the very large turbojet airliner.





Left, Westland's Westminster (two Napier Elands) in its "crane" version is a most useful transporter for heavy construction work in undeveloped areas. Below, the two-seat Hunter (Rolls-Royce Avon) has proved to be a versatile military weapon. Below, right, Folland's light fighter the Gnat is now also produced in two-seat form; both have Bristol Orpheus turbojets. (7)

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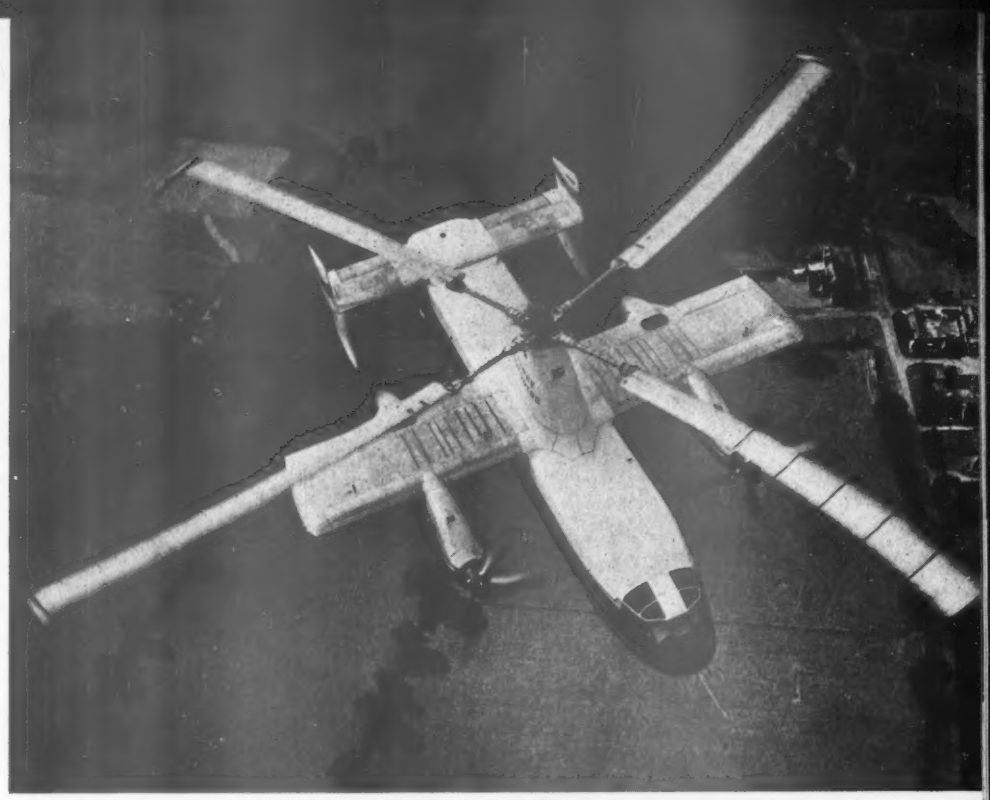


The World's first VTOL transport aircraft, the Fairey Rotodyne. The prototype shown here is Napier Eland powered; production versions will have Rolls-Royce Tynes. (B)

Turbo-engines have also been fitted to British helicopters and have given clear evidence that they can confer upon rotary-wing aircraft benefits as large as those they had conferred upon fixed-wing aircraft. It seems, indeed, that the turbo-engine is about to remove many of the impediments that have retarded the helicopter's operational development.

Great Britain has also retained the lead she gained in the development of military jet aircraft and she has produced a line of warplanes that have found favour with many overseas countries, including those of Latin America. She has also produced jet-engined trainers, and was the first country ever to introduce all-jet training for air force pilots.

All her technical achievements, of course, rest upon the quality of the engines with which they are associated. Many of these engines have also been built under licence in other countries—and on a particularly large scale in the United States—and they have been specified by customers for aircraft which, in standard form, have engines originating in some other country. (Varig, the Brazilian airline, for instance, specified Rolls-Royce Conways for their American airliners.)

Aero-engine sales, in fact, account for more than a third of the £932,800,000 which Britain has earned since the end of World War II by her aviation exports. But in spite of the turbo-engine's conquering march there are still aeroplanes for which the piston-engine is a more suitable source of power, and these, too, the British aircraft industry can supply.

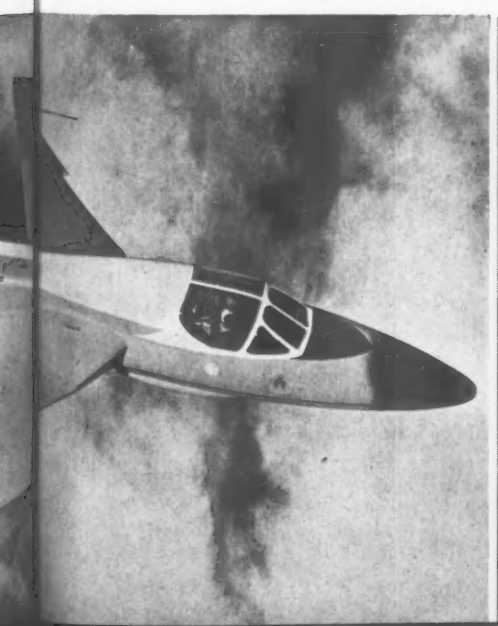
The following notes are intended to be nothing more than a "shopper's guide" to the range of British aircraft and engines. Their main purpose is to show that there is an aircraft or an engine for virtually every aeronautical need.

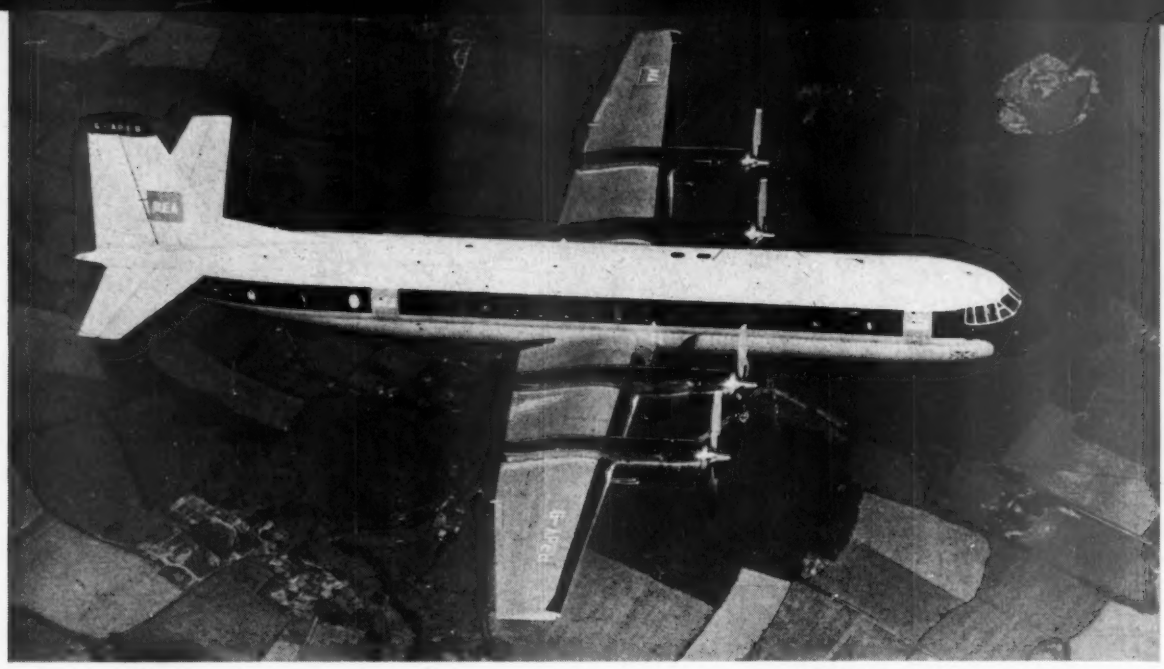
Turbojet Airliners

The first Comets had four de Havilland Ghost turbojets each of 5,000 lb. static thrust. They carried 44 passengers, had an all-up weight of 115,000 lb., a still-air range (with reserve fuel) of 1,770 miles and a normal speed of 450 m.p.h.

The second-generation Series 4 Comets have four 10,500-lb. thrust Rolls-Royce Avon turbojets. The Comet 4 carries 60-81 passengers over international trunk routes; the Comet 4B 72-102 passengers on continental routes, and the Comet 4C the same number of passengers but over a greater distance. Comets 4 and 4C have a normal cruising speed of 500 m.p.h. and an all-up weight of 162,000 lb., the 4B a cruising speed of 530 m.p.h. and an all-up weight of 158,000 lb.

A new de Havilland airliner is now being developed and is as yet known only by its number—D.H.121. This will have its three engines (Rolls-Royce RB.163s, each rated at 10,100 lb. thrust) at the rear end of the fuselage, close to the tail. It is intended for inter-city services and will carry 70 to 80 passengers in a standard seating plan, or 95 to 100 in higher density schemes, at a cruising speed of 600 m.p.h. over stage lengths of approximately 1,000 miles. The Comet's excellent





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A second-generation turboprop airliner, the Vickers Vanguard (four Rolls-Royce Tynes), offers large seating capacity and low-cost operation. (9)

runway performance will be matched by that of the newer airliner.

A second new turbojet type is being designed and built by Vickers, and is known at the moment as the VC-10. British Overseas Airways have ordered 35 and have taken an option on 20 more. Its four 20,250-lb. thrust Rolls-Royce Conway by-pass turbojets will be located in pairs on each side of the rear fuselage. It will carry 108 first-class passengers, or 135 or 152 in high-density seating schemes.

Turboprop Airliners

The Viscount was Britain's (and the World's) first turboprop airliner to go into service on the airways. Its success has made aviation history. By the end of 1959, no fewer than 407 had been ordered by 50 different customers. Seventeen of the 40 airline customers had, by then, placed repeat orders, and the type was still in production.

In its first 10 years the Viscount increased its seating capacity from 32 to 75, doubled its power and increased its speed by 120 m.p.h. Each version has a lower operating cost than that which preceded it. All versions are powered by four Rolls-Royce Dart engines.

The Britannia has the distinction of being the World's first medium- and long-range turboprop airliner. In one version it has a range—with a payload of more than 19,000 lb.—in excess of 5,500 miles, at a cruising speed of 357 m.p.h. Yet it can be operated economically over stages as short as 350 miles.

With high-density seating it can accommodate 133 passengers. Over certain distances it can be used effectually to offset a seasonable fall in passenger traffic by exploiting its 790 cu. ft. of under-floor freight holds. As a freighter it has a payload of 34,000 lb.

A special version of the Britannia is in service with the Royal Air Force Transport Command; the design is the basis of an aeroplane built by a Canadian company, and of a still larger transport for military purposes to be built in Britain.

The first of the second-generation turboprop airliners is the Vickers Vanguard with four Rolls-Royce Tyne engines. The first Vanguards have a cruising speed of 425 m.p.h., but this will shortly be increased to 450 m.p.h. when a more powerful version of the Tyne (a new engine) becomes available. The Vanguard can carry a maximum of 139 passengers.

A new type of turbo-engined aircraft is introduced by the Armstrong Whitworth Argosy—a freighter. The type is also available as a motorcar ferry with accommodation for six cars and 30 passengers, and as an "airbus" with seats for 126 passengers on two decks. Flight trials with the new type are already in progress and its performance figures have accorded with predictions. The Argosy has four Rolls-Royce Darts similar to those which power the Viscount.

Two other British turboprop-engined airliners are contenders for the honour of replacing the versatile and venerable Douglas DC-3 when it decides to retire from the active scene—as one day it must. The earlier of the two is the Handley Page Herald, a 47-seater with a cruising speed of 275 m.p.h., powered by two Rolls-Royce Dart engines. If used as a freighter it can lift a load of 13,000 lb.

The second, the Avro 748, is also Dart-engined, and with tourist seating can accommodate 36 to 47 passengers. Alternatively, the accommodation can be divided between passengers and freight without any structural alterations. The 748 is scheduled to begin its flight trials early this year and has already been chosen for manufacture under licence in India.

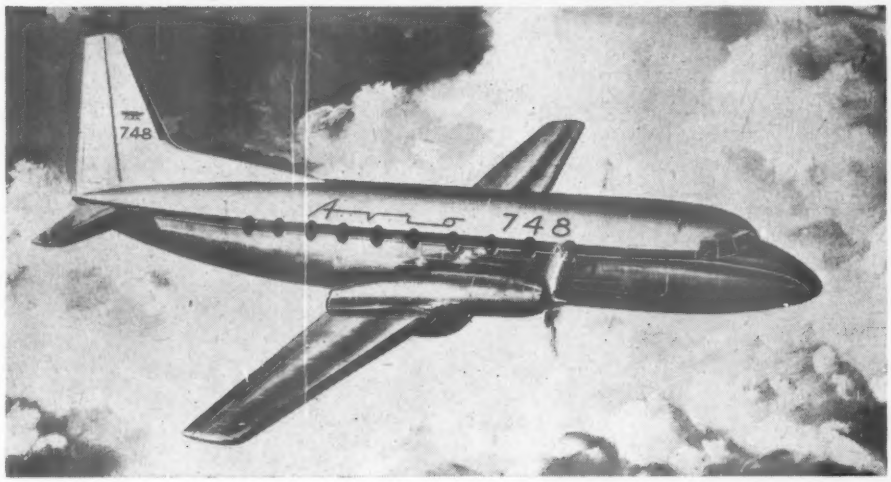
Piston-engined Types

Countries with territories offering poor landing facilities will be attracted by Scottish Aviation's piston-engined airliner, the Twin Pioneer, a brilliant exponent of the short take-off and landing technique. In the course of a demonstration tour of Latin America the Twin Pioneer often used simple jungle clearings as its airfield and visited places which had never before seen a fixed-wing aeroplane. It has seats for 16 passengers and can be readily adapted to other rôles, such as ambulance work and air survey. It is powered by two Alvis Leonides engines.

Another piston-engined type with approximately the same capacity as the Twin Pioneer, and available with fixed or retractable landing gear and fixed- or variable-pitch airscrews, is the de Havilland Heron, which cruises at 182 m.p.h. and has a range of from 575 miles to 1,775 miles according to the payload. The maximum payload is 3,750 lb.

Bristol's Type 192 twin rotor helicopter (two Napier Gazelles) is another weightlifter. (10)

Latin-American Survey . . . .



A most promising turbo-prop transport in the medium-size bracket is the new Avro 748 (two Rolls-Royce Darts). (11)

Versatility is also a feature of the Hunting President. It can be used as a 12-seat feeder-liner, a six-seat "Executive" type, for ambulance work, geophysical or air survey work, or as a freighter with 660 cu. ft. of usable space. It has two Alvis Leonides engines and cruises at 165 m.p.h.

From Miles comes the distinctive little Caravan, a twin-engined freighter with very high aspect ratio wings and large-area flaps which help to give it an exceptionally good one-engine performance—an asset of great merit. It has an all-up weight of 8,000 lb.

Another small freighter is scheduled for production by Short Brothers and Harland, Ltd.—the S.C.7. This is being offered for various duties, and as a feeder-liner will be able to carry 15 passengers.

Among the single-engined types are three built specifically for agricultural work. They are Lancashire Aircraft's Prospector and Auster's Agricola and Workmaster. The first two are for crop dusting and spraying, and the third for spraying only.

Four other single-engined types, all by Auster, are suitable for either flying clubs or the private owner. They are Aiglet—primarily an aerobatic trainer but available also without the special seats—the Alpha, a three-seater, the Autocar, with seats for four, and the Alpine, a three-seater. All are powered by air-cooled engines, inline or horizontally opposed.

Those who have the inclination and ability to build their own light aeroplane are offered kits of parts and building instructions by Phoenix Aircraft. Their Minor is a 37 b.h.p. single-seat braced-wing monoplane, their Major a 62 h.p. two-seater.

Rotary-wing Craft

Of the 10 available craft in this category, six have turbo-engines of one form or another, and two more which normally fly with piston-engines have been experimentally fitted with turbo-engines.

The turbo-engined types are the Bristol 192 (two Napier Gazelle free-turbine engines), a naval helicopter capable of carrying 18 passengers in civil form; the Fairey Ultra Light two-seat liaison type with rotor-tip pressure jets fed with compressed air from a turbine-driven compressor (Blackburn Palouste); Fairey Rotodyne 57-seat airliner with rotor-tip pressure-jets fed with compressed air from auxiliary compressors driven by turbine engines (Rolls-Royce Tynes) which in cruising flight drive propellers whose blades, when the auxiliary compressors are engaged for vertical or hovering flight, run in fine pitch and absorb little or no engine power;

Designed specifically as a general-purpose transport the Armstrong Whitworth Argosy (four Rolls-Royce Darts) can be used for freight or passenger carrying or for mixed loads. (12)

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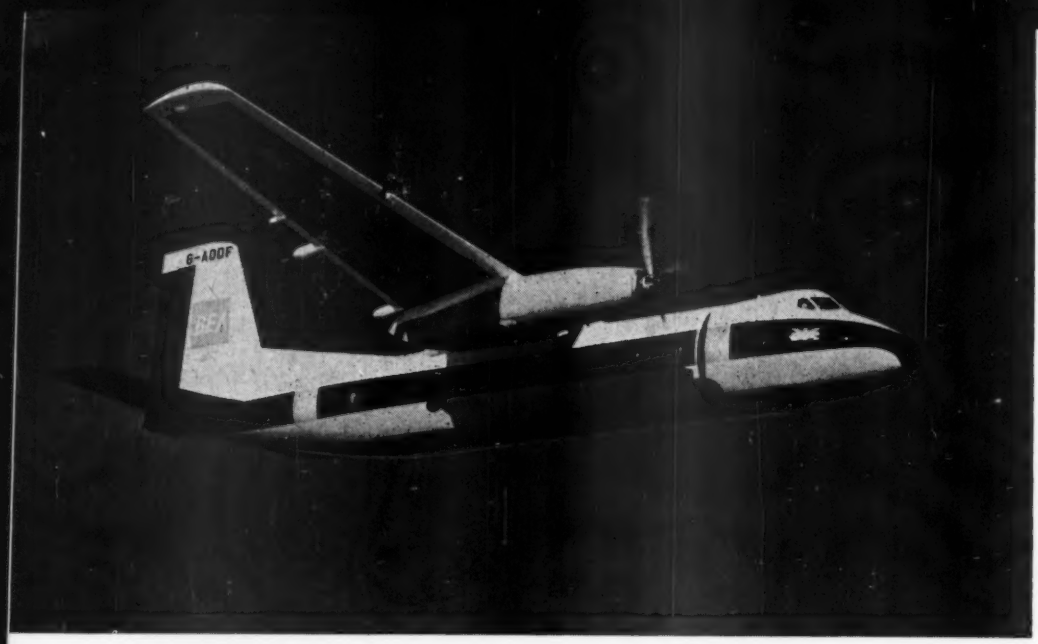

A promising medium-size transport, the Handley Page Herald (two Rolls-Royce Darts) is well suited for operation in restricted areas and for small airfields. (13)

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the Saunders-Roe Wasp (which, in civil form, has a five-seat capacity) with a Blackburn Turmo 600 shaft turbine; the Westland Wessex, a naval helicopter with a single Napier Gazelle and capable of adaptation as a 12-passenger civil type, and the Westland Westminster, with two Napier Eland turbine engines, built first as a flying crane for lifting objects weighing up to five tons or so, but lending itself to a civil rôle as a 50-passenger rotary-wing airliner.

The piston-engined types are the Bristol Sycamore (4/5-seater) with Alvis Leonides engine; the Westland Widgeon (pilot and four passengers) with Leonides engine; the Westland Whirlwind (Leonides or American engines), used mainly for military duties but capable of conversion to 8/10-passenger civil type with crew of two, and the Saunders-Roe Skeeter two-seater.

Military Aircraft

Great Britain's heavy bomber programme has been confined to three four-engined turbojet V-bombers—the Vickers Valiant, with 10,000-lb. thrust Rolls-Royce Avons, the Avro Vulcan, with the 16,000-lb. thrust Bristol Siddeley Olympus, and the Handley Page Victor with the 11,000-lb. thrust Bristol Siddeley Sapphire. (Later versions of the Victor have 17,250-lb. thrust Rolls-Royce Conways.) Few performance details of these bombers have been released, but it is known that the Valiant, the first to go into service, has a maximum speed of Mach 0.9, or 650 m.p.h. at 10,000 ft.

The standard British light bomber is the English Electric Canberra, another version of which is designed for high-altitude photographic reconnaissance. Both versions have two Rolls-Royce Avons.

Among the fighters are the Hawker Hunter single-seat day interceptor (10,050-lb. thrust Rolls-Royce Avon), which has a maximum level flight speed of 720 m.p.h. at sea level; the Folland Gnat light fighter (Bristol Siddeley 4,250-lb. thrust Orpheus); the Gloster Javelin (two Bristol Siddeley 11,000-lb. thrust Sapphires), an all-weather day and night fighter, and the English Electric P1B (two Rolls-Royce 11,250-lb. thrust Avons) day and night supersonic fighter.

Naval fighters include the Hawker Sea Hawk (Rolls-Royce Nene), with a maximum speed of 530 m.p.h.; the de Havilland Sea Vixen (two 10,000-lb. thrust Avons) an all-weather fighter; the Blackburn NA.39, with two D.H. Gyron Juniors of 7,000-lb. thrust each, and the Supermarine Scimitar, powered by two 11,250-lb. thrust Rolls-Royce Avons.

Another naval aircraft is the Fairey Gannet which, among other rôles, plays the part of an airborne early warning aircraft. It has a single Bristol Siddeley Double Mamba turboprop rated at 3,875 s.h.p.

For maritime reconnaissance there is the Avro Shackleton, powered by four Rolls-Royce 2,450 b.h.p. Griffon piston engines. This type can also be used for trooping and for close support.

Two heavy military transports are available. One is a modified version of the Bristol Britannia, and the other the Blackburn Beverley which, powered by four Bristol Siddeley 2,850-b.h.p. Centaurus piston engines, has a maximum speed of 238 m.p.h. and an all-up weight of 135,000 lb.

The industry's only air observation post aeroplane in general use is Auster's A.O.P.9, with a Blackburn Cirrus-Bombardier air-cooled piston engine of 180 b.h.p.

Five military trainers are included in the catalogue. They are the de Havilland Vampire, with side-by-side seating (one D.H. 3,500-lb. thrust Goblin turbojet); the Hawker Hunter, side-by-side seater (one 8,050-lb. thrust Rolls-Royce Avon); the Hunting Jet Provost side-by-side seater (1,750-lb. thrust Bristol Siddeley Viper turbojet); the Folland Gnat Trainer, with tandem seats (Bristol Siddeley 4,230-lb. thrust Orpheus turbojet); and the Miles Student, side-by-side seater (883-lb. thrust Turboméca Marboré turbojet).

British Aero-Engines

TURBOJET.—Bristol Siddeley Viper (1,900-3,000-lb. thrust); Orpheus (4,230-8,000-lb. thrust); Sapphire (11,000-lb. thrust); Olympus (17,000-lb. thrust); de Havilland Gyron Junior (10,000-lb. thrust); Rolls-Royce R.B.145 (2,750-lb. thrust); Avon (10,500-13,220-lb. thrust); R.B.141 (12,000-lb. thrust); Conway (17,500-20,250-lb. thrust); R.B.163 (10,100-lb. thrust).

TURBOPROP AND TURBOSHAFT ENGINES.—Bristol Siddeley P.181 and 182 (1,020 s.h.p.); Double Mamba (3,875 e.h.p.); Proteus 765 (4,445 e.h.p.); Blackburn A.129 (840 s.h.p.); Blackburn Turmo 600 (450 s.h.p.); D.H. Gnome (1,000 s.h.p.); Napier Gazelle (1,800 s.h.p.) and Eland (3,500 e.h.p.); Rolls-Royce Tyne (5,525 e.h.p.) and Dart (2,105 e.h.p.).

GAS GENERATOR.—Blackburn Palouste (252 e.h.p.).

PISTON ENGINES.—Alvis Leonides (520 b.h.p.) and Leonides Major (875 b.h.p.); Bristol Siddeley Centaurus (2,625/3,150 b.h.p.) and Hercules (1,690/2,300 b.h.p.); Blackburn Cirrus-Bombardier (180 h.p.); de Havilland Gipsy Queen (240/380 b.h.p.) and Gipsy Major (139/215 h.p.).

ROCKET ENGINES.—Napier Double Scorpion (4,000 to 6,000-lb. thrust); Bristol Siddeley Gamma (16,400-lb. thrust); de Havilland Spectre (8,000-lb. thrust) and Double Spectre (16,000-lb. thrust).

RAMJET.—Bristol Siddeley Thor (thrust at sea level at Mach 3.0 about 20,000 lb.).

The Saunders-Roe Wasp (one Blackburn A.129 or Turmo) developed primarily for Service use has considerable potential as a light civil transport. (14)

Nothing beats these drums

Up the river Tocantins in drums — that's the way aviation fuel is delivered to Carolina airport deep in the interior of Brazil. But the Tocantins is a treacherous river riddled with dangerous rapids. Progress is slow and time after time the big drums must be unloaded to make the river boats light enough to winch by hand through the swirling waters.

On the first leg of the 750-mile trip, from Belem to Maraba, no fewer than five of these transhipments may have to be made. And each time the drums must be heaved up the bank and often hand-rolled round the rapids. At one spot, however, a little wood-burning railway does the job. At another, a truck — the only one for miles — helps out. But at a third spot the drums must be dragged through the water. The undergrowth is too dense to go overland.

At Maraba, the drums are transferred to smaller, more agile craft. But the endless unloading-hauling-loading sequence continues. Once, twice, three times — perhaps more. It all depends on the state of the river. Sometimes a round trip can take up to seven months to complete. But the supplies get through and an important fuelling stage on the Brazilian network is kept open. The tireless crews make sure of that. And so does Shell.

No matter where an airport is situated, Shell will always find a way to supply it.

SHELL

you can be sure of Shell

The Handley Page Herald . . .

Throughout 32,000 miles of the South American and Caribbean Tour, Electro-Hydraulics undercarriages and equipment proved 100% reliable and although spares were carried throughout the tour, none were used.

About 200 miles across the Himalayas from Srinagar — in a valley in the upper reaches of the Indus — is Leh's airstrip — 11,000 ft above sea level. Running steeply downwards (at the rate of 4 feet in every 12 yards), it terminates in a 500 ft hill surmounted by a monastery — at the approach end is the mountainside.

Handley Page's crew described it in this way: "You fly downwind and can see the runway, but then you have to fly round a hill which is a good 1,500 ft above the touch-down point. Here you fly between two hills with no more than a couple of hundred yards to clear through, turn round the larger hill on to the final turn for the run-in and once round you see the aerodrome again. Making your approach, practically throttled back, you find you are losing height at the same rate as the ground slopes. The surface is simply loose sand. . . . It certainly wouldn't do for London Airport."

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MEMBER OF THE OWEN ORGANISATION

Twelve Months of Comet Operation

IN their first year of operations with British Overseas Airways Corporation, de Havilland Comet 4s carried 76,000 passengers and worked a total of 15,150 revenue flying hours. In covering nearly 6½ million route miles, these aircraft achieved a better record of punctuality than any aeroplane previously used by B.O.A.C. on the North Atlantic routes.

B.O.A.C. dollar earnings, in the first 12 months of Comet service, increased by 32% compared with the previous year, and the attraction of the Comet certainly played a large part in making this increase possible. Just how attractive jet travel has proved is shown by the fact that, during the year, B.O.A.C. took second place among Atlantic carriers, beating T.W.A. for the first time. The overall load factor in B.O.A.C. Comets in the first year on Atlantic and Eastern routes was 75%, and the passenger load factor was 78%.

Regular passenger services with the Comet began on October 4, 1958, when one service in each direction was operated between London and New York—the World's first jet services across the Atlantic. Three of the B.O.A.C. fleet of Comet 4s had by then been delivered—two on September 30 and one on October 2. B.O.A.C. was able to start services immediately, dispensing with the usual long period of proving and training, because it had a nucleus of Comet-trained pilots, because it had completed many Atlantic operations with the Avon-engined Comet 2Es, and because the Comet 4 was already one of the most fully-developed airliners ever produced.

At first, only one flight a week in each direction was planned, but on November 14 this was increased—after the set-back caused by the B.O.A.C. engineering strike at the end of October—to a daily frequency. A weekly service to and from Montreal was started on December 19, 1958, and, during the summer peak of 1959, 14 services a week were operated on these two Atlantic routes. With a few exceptions, B.O.A.C. has used its Comets on the Atlantic for Monarch services with only first-class and de luxe accommodation.

With the delivery of more aircraft, Comet services were extended to the Eastern routes on April 1, 1959, with a four-times-a-week service to Hong Kong and Tokyo (since increased to 10 services a week to the Far East). Connections at Hong Kong and Tokyo with the Corporation's Britannia "west-about" service through New York and San Francisco enabled B.O.A.C. to advertise the first all-turbine round-the-World service (although this service was prevented from starting on a regular basis until August 22 by objections raised in the U.S.).

Since the end of the Comet's first year of operation, other services have been inaugurated—on the Kangaroo route to Sydney on November 1, 1959 (five a week); on the route to Johannesburg on December 2, 1959 (four a week); and now, on January 25, 1960, twice a week to Recife, Sao Paulo, Montevideo, Buenos Aires and Santiago.

The punctuality of the Comet, already mentioned, is shown in detail in the two tables on this page. They show that 50% of flights on the Western routes (London to New York and Montreal) arrived within 15 minutes of the advertised time and another 15% within 30 minutes. Westbound on these routes the results were even better, with 73% of arrivals not more than 30 minutes late.

On the Eastern routes the record is not quite so good—as might be expected on a multi-sector operation where delays tend to become cumulative. Even here, though, the results are satisfactory, and the overall figure of 78% of all Comet arrivals within one hour of advertised time in the first year of operation is one of which any airline (and manufacturer) would be proud.

The analysis of causes of delays shows that the weather was responsible for as much lost time on the Western routes as all other causes together, while engineering and maintenance delays were responsible for almost exactly half of all the lost time on the Eastern routes. This, again, was to be expected by the nature of the routes.

It is also worth noting that the period under review covers a full year of Atlantic operations, but only the first six months of Eastern route services—and results for the latter can therefore be expected to improve further as time goes on.

Early experience with the Comet 4 showed that most of the engineering delays which did occur were attributable to aircraft systems; powerplants and associated systems had a better record than any others in B.O.A.C. service and in one year of service on the Atlantic there has not been a single failure of a Rolls-Royce Avon engine in flight and only one engine shut-down (due to the failure of a fuel-control unit).

The number of maintenance man-hours required per flying hour has been coming down steadily since the Comet went into service. Starting at nearly 60 man-hours in October, 1958, it had reduced to 28 man-hours by the autumn of 1959 as the aircraft settled down and the engineers gained experience.

Table 1.—TERMINAL ARRIVAL PUNCTUALITY

	Western Routes	Eastern Routes	Overall
Number of flights	981	471	1,452
On time or early	39%	29%	35%
Within 15 minutes	50%	44%	48%
Within 30 minutes	65%	53%	62%
Within 1 hour	83%	66%	78%
Within 6 hours	97%	89%	95%
Within 12 hours	98%	92%	96%
Within 24 hours	99%	97%	98%

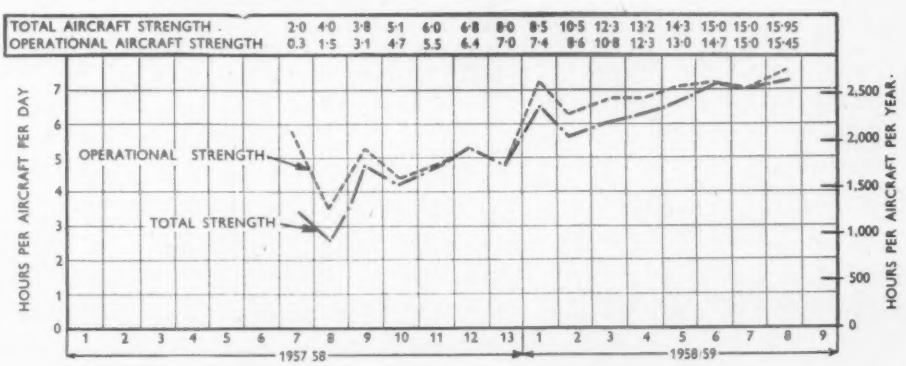
Table 2.—ANALYSIS OF CAUSES OF DELAY

Cause of Delay	Hours Lost per 100 Scheduled Elapsed Hours		
	Western	Eastern	Overall
Weather	5.5	3.6	4.4
Engineering and Maintenance	2.6	9.4	6.5
Operations	1.2	2.7	2.1
Traffic	0.4	1.8	1.2
Consequential	1.3	2.1	1.8

Aircraft utilization has been going up steadily. In the last month of the first year, with 16 aircraft delivered, the annual utilization rate was 2,600 hours per aircraft. Daily utilization was between 7½ and 8 hours per aircraft. With all the aircraft delivered and operational and the bulk of the crew-training programme completed, next summer should see B.O.A.C. achieving an annual rate of not less than 3,000 hours with daily rates of at least 10 hours for peak periods.

Of the Comet, Mr. Basil Smallpeice, managing director of B.O.A.C., said recently: "This impressive record of its first year's service on the Atlantic gives a foretaste of the regularity of operation B.O.A.C. will be able to offer the travelling public of the World on its Eastern and Southern routes, the routes for which the Comet's payload and operational capabilities are specially suited.

"I believe we have every reason to feel pride in what has been achieved and faith in our ability to match these achievements in the years ahead. For us in B.O.A.C., there could be no finer aircraft than the Comet 4 in which to express that faith."



This graph shows how B.O.A.C. Comet utilization has built up since the start of operations in October, 1958. (15)

Facts and Figures About the Comet

DE HAVILLAND'S Comet 4 is descended from the World's first jet airliner, and can with justice claim to be the most tested and developed of modern turbojet transports. Outstanding features are its high thrust-to-weight ratio—0.26 : 1 compared with 0.21 : 1 for the Boeing 707-120—and its modest wing loading, 76 lb./sq. ft. as against 102 lb./sq. ft. for the Boeing. These features account for its ability to operate safely from much smaller airfields than the large U.S. jets and for its outstanding rate of climb on take-off. It has no peer as a jet transport for routes that do not have giant airfields and the large traffic potential of the North Atlantic.

Three versions of the Comet are currently available. The first, the Series 4, is the type in service with British Overseas Airways Corporation and Aerolineas Argentinas; it has also been ordered by East African Airways. The second version, the Comet 4B, has been developed for British European Airways; it is designed for operation at higher speeds over shorter ranges. It has a longer fuselage than the Series 4 and a shorter-span clipped wing without pinion tanks. B.E.A. services with Comet 4Bs will begin next April; this aircraft has also been ordered by Olympic Airways.

The Comet 4C represents a compromise between the long-range Series 4 and the 4B; it has the same wing, fuel capacity and all-up weight as the Comet 4, but has the larger-capacity fuselage of the Comet 4B. The Comet 4C has been ordered by Cia. Mexicana de Aviacon and by the Egyptian Misrair.

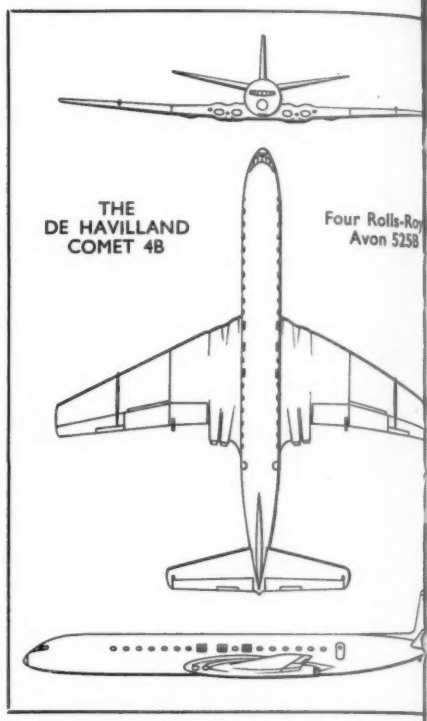
The Comet 4 is powered by four Rolls-Royce Avon RA.29 turbojets, each giving 10,500 lb. thrust for take-off. Specially designed as a civil powerplant, the RA.29 differs from earlier military Avons in having a 16-stage compressor with a 9.27 : 1 pressure ratio and a three-stage turbine.

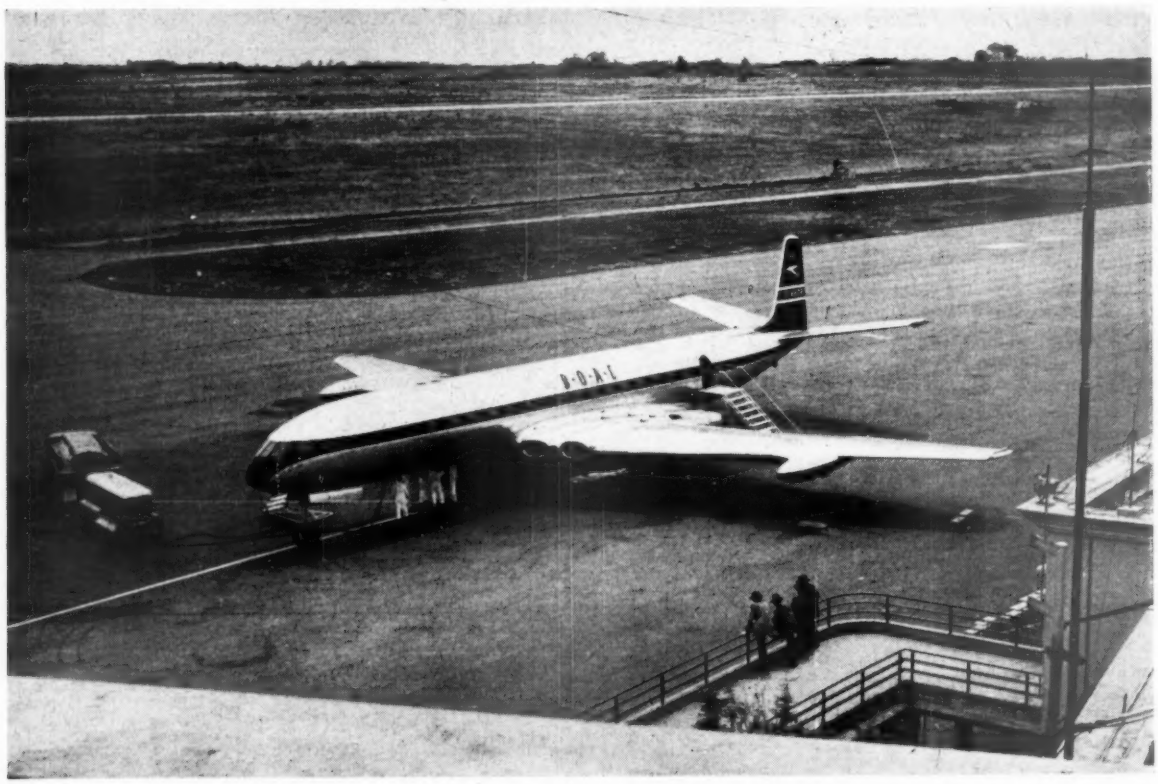
An impressive feature of the RA.29 has been its rapid increase in overhaul life. Largely as a result of flight experience in Comet 2Es the engine had reached an initial overhaul period of 1,000 hours by the time the Comet 4 entered service late in 1958. Only a year later this had been increased to 1,600 hr. In these 1,600 hr. between overhauls an Avon flies more than 700,000 miles; during this time no component changes or internal inspections are necessary.

Structural design of the Comet has been based on establishing a safe fatigue life and, in addition, fail-safe features have been incorporated in the design. Stress levels have been kept low so that cracks in the structure are unlikely to develop in service, and if they do they will spread only very slowly. The fuselage skin has a minimum thickness of 19 s.w.g. and the working stress is only 22% of the ultimate. Doubler plates are bonded on at fuselage cut-outs.

The wing is made up of a centre section, two stub wings and two extension

(*Continued on page 111*)

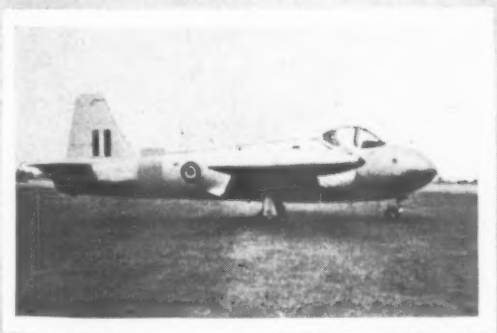




A Comet 4 of B.O.A.C. being serviced at Carrasco airport, Montevideo, during a proving flight. (16)

Jet Provost

The Royal Air Force standard
primary and basic trainer
powered by the
Bristol Siddeley Viper



XM346

HUNTING AIRCRAFT LIMITED

A Hunting Group Company

LUTON AIRPORT, LUTON, BEDFORDSHIRE, ENGLAND and at 1450, O'CONNOR DRIVE, TORONTO, CANADA.

Marconi in the Comet 4

Equipped by Marconi to meet the major radio requirements of a modern airliner

MARCONI

COMPLETE AIRCRAFT AND AIRPORT RADIO SYSTEMS

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

M.2A

(*Continued from page 110*)

wings, with two-spar construction inboard. Wing tension members and skins are of copper-bearing alloy to ensure good fatigue properties.

Exhaustive fatigue tests of components, complete wings and tailplanes and the pressure cabin have been made in developing the Comet 4. The aim has been to ensure a safe life of at least 30,000 hr., equivalent to 10 years of operation at 3,000 hr. per year; during this time the aircraft will fly some 15 million miles. Assuming a flight duration of 3 hr. this means that the semi-monocoque fuselage will have been pressurized 10,000 times.

In tests the fuselage has withstood a simulated operating life of more than 200,000 hr., although this does not allow for the safety factor applied to such tests. Safe fatigue lives for the main spars have been shown to exceed 80,000 hr. by full-scale fatigue tests.

The aircraft's power-operated flying control system is fully duplicated mechanically and supplied by three independent sources of hydraulic power. There is spring-feel on all flying-control circuits and dynamic-pressure ("q") feel on the elevator control only. In the rudder circuit a "q" restrictor limits rudder deflection at high speeds. There are two gear-ratios on the elevator control; the pilot selects the changeover from coarse to fine control at 170 to 200 knots I.A.S.

The 2,500-p.s.i. hydraulic system has four circuits and is supplied by four engine-driven pumps, with two electrically-driven pumps as a reserve. It provides power for operating the flying controls, undercarriage, flaps, air brakes, wheel brakes and nose wheel steering. The undercarriage has four-wheel bogie main units and a two-wheel nose unit.

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The cabin pressurization system is fed by air tapped from all four engines; air from two engines is used normally and that from the other two acts as a stand-by supply. Control is automatic.

Hot air tapped from the compressors of all four engines is used for thermal de-icing of wings, tailplane, fin and engine intakes. Cockpit windows are demisted by electrically heated gold-film glass; only the windscreen panels immediately in front of each pilot are continuously de-iced.

Bag fuel tanks are installed in the wing centre-section; all other fuel tanks are integral. Engines are normally fed independently; the tanks are filled by means of an underwing pressure refuelling system.

TECHNICAL DATA

	Mark 4	Mark 4B	Mark 4C
DIMENSIONS:			
Wing span, ft. in.	114 9	107 10	114 9
Overall length, ft. in.	111 6	118 0	118 0
Overall height, ft. in.	29 6	29 6	29 6
Gross wing area, sq. ft.	2,121	2,059	2,121
Sweepback, deg. at 25% c.	20	20	20
Internal cabin dimensions, excluding flight deck:			
Length, ft.	71.73	78.23	78.23
Max. width, in.	115.7	117	117
Max. height, in.	78.7	78.5	78.5
Max. usable floor area, sq. ft.	439	529	529
Max. usable volume, cu. ft.	2,815	3,160	3,160
Total volume and number of baggage and freight holds—outside cabin volume, cu. ft.	570(3)	640(3)	640(3)
ACCOMMODATION:			
Normal first class	60	72	72
Normal tourist	79	92	92
Max. coach	81	102	102
POWERPLANTS:			
Type	Avon 524	Avon 525	Avon 525B
Rated take-off power (I.S.A. at s.l.) lb. s.t./r.p.m.	10,500/8,000	10,500/8,000	10,500/8,000
WEIGHTS AND LOADINGS:			
Basic operational, lb.	74,900	77,200	77,700
Total usable fuel, lb.	71,200	62,400	71,200
Mfrs. max. capacity payload, lb.	20,300	24,600	24,600
Max. take-off, lb.	162,000	158,000	162,000
Max. landing, lb.	120,000	120,000	120,000
Max. zero fuel, lb.	99,000	102,500	102,500
Wing loading, max. take-off wt., lb./sq. ft.	76.4	76.7	76.4
Wing loading, max. landing wt., lb./sq. ft.	56.6	58.2	56.6
Power loading, max. take-off wt., lb./lb. s.t.	3.86	3.76	3.86
DESIGN LIMIT SPEEDS:			
Mc/Vc, knots E.A.S.	0.76/280	0.76/325	0.76/275
Mno/Vno, knots I.A.S.	0.78/320	0.77/355	0.78/305
Md/Vd, knots E.A.S.	0.84/360	0.84/405	0.84/355
PERFORMANCE:			
Recommended continuous cruising speed, knots	448	462	442
At altitude, ft./weight, lb.	28,500/135,000	23,500/135,000	33,000/135,000
With consumption, Imp. gal./hr.	1,140	1,430	1,090
Approach speed (1.3 Vso), knots/weight, lb.	115/100,000	120/110,000	115/100,000
Balanced field length, at max. take-off wt.:			
I.S.A. at s.l., ft.	6,750	6,600	6,750
I.S.A.+15°C. at s.l., ft.	7,500	7,450	7,500
I.S.A. at 5,000 ft.	9,300	9,300	9,300
Landing distance required (SR 422A) at max. landing wt., ft.	6,630	6,660	6,630
Range with max. fuel, take-off to landing, no reserves, still air, I.S.A., naut. miles	3,920	3,300	3,890
With payload, lb./fuel, Imp. gal.	16,400/8,900	19,100/7,800	13,800/8,900
At mean speed, knots/altitude, ft.	405/37,000	405/37,000	405/37,000
Range with max. payload, naut. miles	3,640	2,920	3,140

A view from the passengers' bus of the Comet ready for take-off at Cumbica airport, Sao Paulo. (17)

Photographs copyright "The Aeroplane and Astronautics"

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M.2A

(*Continued from page 110*)

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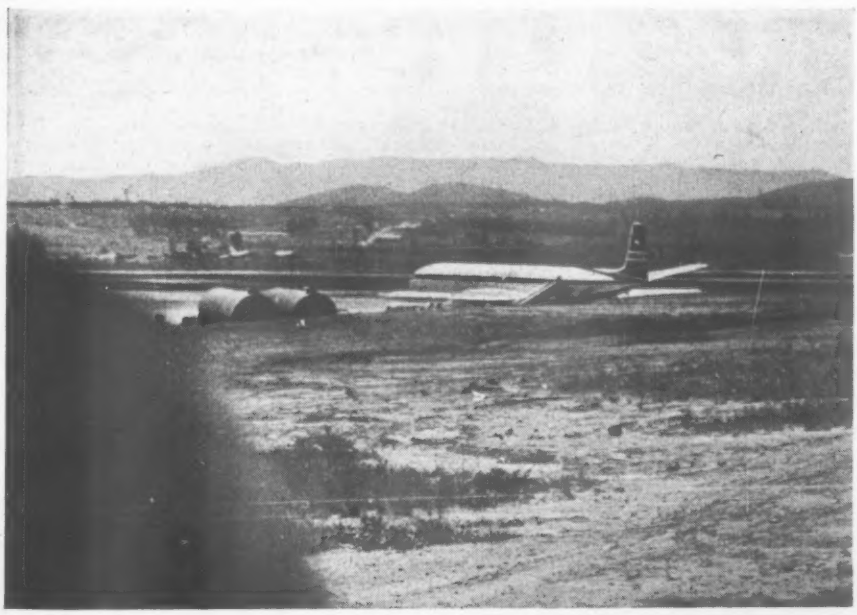


A view from the passengers' bus of the Comet ready for take-off at Cumbica airport, Sao Paulo. (17)

Photographs copyright "The Aeroplane and Astronautics"

Latin-American Survey . . . .

Two of the Junkers F.13 floatplanes used in the 1920s by SCADTA, the German-Colombian predecessor of Avianca, for airline operations from its base at Barranquilla.

Forty Years Young

BECAUSE of the rapid expansion of the airline industry in South America during the past 15 years there is a tendency elsewhere to think of air transport as something which has only recently come to help to open up this vast continent. The industry in South America has roots which are as old as those in Europe—generally considered to be the birthplace of serious scheduled airline operations.

The first airline in the western hemisphere was formed in Colombia in December, 1919, by German interests. This carrier—Sociedad Colombo-Alemana de Transportes Aéreos, or SCADTA for short—continued to exist under its original name until 1940, when a merger resulted in the present Avianca, which remained as Colombia's sole operator until 1954. In Brazil, Varig's history goes back to 1927 as an all-national airline and Cruzeiro's to the same year, when its predecessor, the Kondor Syndikat (a Lufthansa affiliate) was formed. Lloyd Aéreo Boliviana was founded in 1925 by German colonists, and the name of Faucett (Peru) goes back in air transport history to 1928.

In fact, at least seven Latin-American airline names of today have remained unchanged since 1930. In addition to Varig, L.A.B. and Cia de Aviacion Faucett, mentioned above, Panair do Brasil, Cia Mexicana de Aviacion, Linea Area Nacional (now known as LAN-Chile), and Pan American-Grace were in active operation before 1931. At that time there were only six present-day airline names on the continent of Europe; five, including American Airways (now Airlines) and T.W.A. (then Transcontinental and Western Air and now Trans World Airways), in the U.S.A.; three—the original Q.A.N.T.A.S., Australian National Airways (now integrated as Ansett/A.N.A.) and MacRobertson Miller—in Australia; and just one, Airwork, in the United Kingdom.

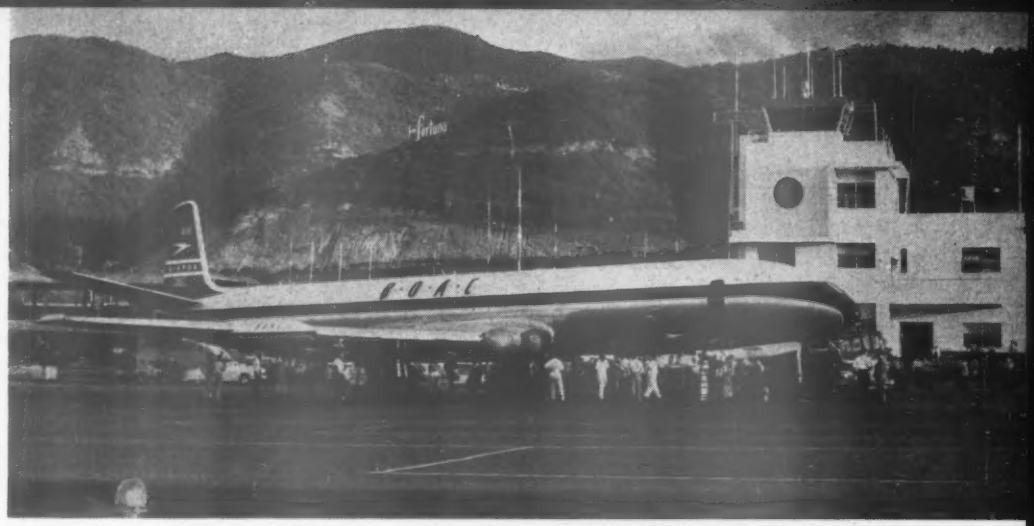
So there is nothing so new about air transport in Latin America—though many carriers have come and gone, or been taken over by other airlines, even during the 15 years of post-War history. Argentina's major international operator, Flota Aérea Mercante Argentina, for instance, merged into Aerolíneas; Brazil's Aerovias and Nacional have become part of the REAL consortium; and, of the once-extensive TACA group, only one airline remains under that name operating in the Central American area where Lowell Yerex, the founder of Trans Aéreos Centrale Americanos, pioneered services in the 1930s and 1940s.

In terms of revenue ton-miles performed, the giants in the Latin-American continent are now REAL of Brazil and Avianca of Colombia, with totals for 1958 topping the 50-million mark.

The former is still primarily a domestic operator with a fleet which is predominantly twin-engined (including 65-70 DC-3s), though a long-haul international service is flown between Argentina, Uruguay, points in Brazil, Trinidad, Venezuela and the U.S.A. (Miami). From relatively small beginnings as Redes Estaduais Aéreas, Ltda., in 1946, REAL has built up its size by a succession of take-overs and mergers with half a dozen other airlines.

Avianca, on the other hand, is primarily an international and intercontinental operator, with services into the U.S.A., Europe and neighbouring South American countries, and a busy network in the Caribbean area. It may be considered to derive its strength and traffic rights from being a " grandfather "

Some three decades later, in 1955, a Cubana de Aviacion L-1049 is seen on the apron at Rancho Boyeros Airport, Havana.



The Comet 4 at Maiquetia Airport, Carácas, Venezuela, during route-proving flights in 1958 before its introduction into service with B.O.A.C.

airline and an associate of Pan American, and from the effect of having a monopoly of Colombian air transport between 1940 and 1954.

Runners-up among the 30-50 million ton-milers in South America are Aerolíneas Argentinas, Panair do Brasil, Varig (Brazil) and Mexicana.

Aerolíneas has been in the news as the first turbojet operator in the continent with three (now two) Comet 4s and three more to come. It is Argentina's "chosen instrument," is in effect a department of the Ministry of Transport, was formed in 1949 from an amalgamation of airlines which already had minority Government holdings, and operates domestically and to Europe, U.S.A. and neighbouring South American countries. There are seven other airlines in Argentina, but only one of these, Transcontinental S.A., operates internationally—to Rio, Carácas and New York.

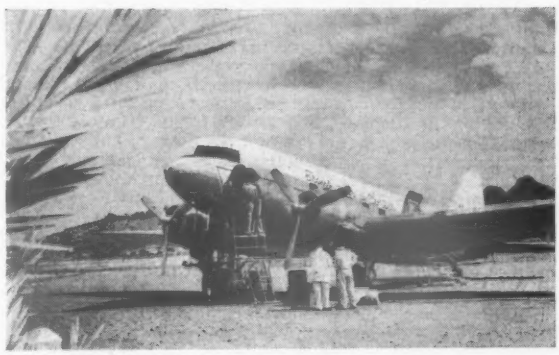
Formed in 1929 as Nyrba do Brasil (the first word made up from that of the parent operator, New York, Rio and Buenos Aires Airlines), Panair was renamed the following year when Nyrba was taken over by Pan American.

Varig (or, to give its full title, S.A. Emprésa de Viação Aérea Rio Grandense) is the oldest airline in Brazil, is all-national and has been expanding rapidly since 1946 as a domestic and international carrier.

Organized in 1924 (for oilfield payroll transport in the days of banditry), Cia Mexicana de Aviacion is Mexico's major airline. Between 1929 and 1944 it was a wholly owned subsidiary of Pan American, which still retains a holding. International services are flown into the U.S.A. and to Cuba.

Behind these bigger operators are many small and some not-so-small airlines which, between them, do an immense job of work. There are, in all, more than 65 scheduled airline operators in South and Central America, and some 15 of them record annual revenue ton-mile totals between 10 and 55 million—which puts them in size categories between, say, Finnair and Lufthansa in Europe and between the biggest local service carriers and Western Air Lines in the U.S.A.

There are one or two areas, in particular, where the traffic volume is reaching the levels to which we have now become accustomed in the U.S.A. Between Rio and São Paulo, for instance, the traffic density is almost twice that on the London-Paris run and São Paulo's Congonhas airport handles about the same number of passengers as the two Paris airports together. Total South American traffic is believed to be about equal to that of Europe.

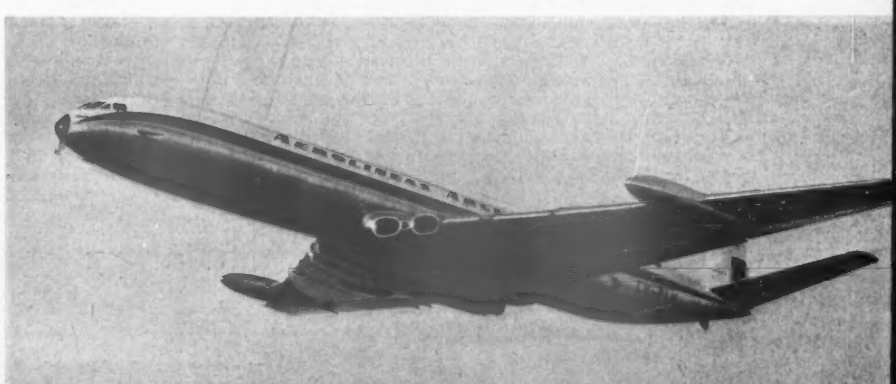


The workhorse: one of Trans Mar de Cortes DC-3s in a typical Mexican setting.

But the airlines in Latin America will not have forgotten that much of the basic air transport pioneering on the continent was done from Europe and North America. In particular, France's Aéropostale operations within the continent and across the South Atlantic will be remembered and Pan American and Panagra developed services in Central America and down the west coast of South America, providing essential radio and airport facilities as the network was extended.

Aéropostale, in fact, remained as a name (Aéroposta Argentina) until the formation of Aerolíneas in 1949. Germany's Lufthansa had a major pre-War influence on South Atlantic operations and airlines in Bolivia, Brazil, Colombia, Ecuador and Peru—such as SCADTA (now Avianca), Lloyd Aéreo Boliviano and the Kondor Syndikat (now Cruzeiro)—remained under German influence until 1940. Finally, K.L.M. has been, and still is, a power in the Caribbean area.

Above, the DC-3 replacement appears: one of five F-27s which are now in service with Avensa in Venezuela.



Right, one of Aerolíneas Argentinas' Comet 4s which are in long-haul service to the U.S.A. and Europe from Buenos Aires.

Latin-American Survey . . . .

Latin-American Air Power

LATIN AMERICA is not generally regarded as a cradle of air power, and it is a little-known fact that Mexico was one of the first countries in the World to employ aircraft for offensive purposes. This was in 1911, when the Mexican Government engaged an American pilot to fly reconnaissance and bombing operations, with some success, against revolutionary forces.

Both constitutional and insurgent armies in Mexico were using aircraft, albeit in very small numbers, before the start of World War I, and military aviation had also established itself in several other countries in Central and South America by that time. These not only included the larger Republics, such as Argentina and Brazil, but also some of the smaller states, represented by Chile and Peru.

Many other Latin-American countries followed their example, as the War in Europe began to demonstrate the potential of air power. Although they received a few aircraft from Europe, however, which was the only real source at that time, further expansion inevitably had to await the conclusion of the Armistice. Numerous missions then arrived, principally from Britain, France and Italy. The proximity of some of the Central American states, such as Cuba, to the U.S., resulted in an effective post-War liaison and military aid from the latter country, which also sent a naval aviation mission to Peru.

The vast stretches of coastline possessed by many Latin-American Republics resulted in the formation, in several countries, of naval air arms, although the primary air force structure was in all cases tied closely to the national armies. Because of the apparently inherent political instability, which then characterized much of Latin America, the armed forces were geared largely to internal security operations, but the general unrest also inhibited the growth in military air organization in many of the countries.

As a potentially lucrative market for the European aircraft industries, Central and South America were first flooded with war-surplus aircraft from the victorious Allied powers, but the World-wide depression of the late 1920s prevented a major sales expansion. Some effort was made in the larger countries to establish indigenous aircraft industries. A Military Aviation Factory was set up in the Argentine in 1927, and started its activities by building British and French training and operational aircraft under licence. Mexico also began building a nationally designed biplane for training and reconnaissance.

Brazil followed these examples in the mid-1930s with the construction of both national and German designs. By then, Latin-American air power had begun to accelerate its expansion, and had been engaged for the first time in warfare between two of the member states. A prolonged boundary dispute between Bolivia and Paraguay had resulted, in 1932, in the Gran Chaco campaign, in which the Italian aircraft of the *Fuerza Area del Paraguay* encountered the American types, in Bolivian service, in spasmodic air combat. Air power was hardly decisive in this campaign, which culminated in a Paraguayan victory in 1935, and economic exhaustion for both countries.

The Peruvian Air Force had also flown operationally in 1933 during a frontier dispute with Colombia, but again these missions were on a very minor scale.

In the latter half of the 1930s the U.S. aircraft industry began to take a great interest in the Latin-American market, with considerable success. A substantial number of military aircraft were exported to most of the 17 or so countries which then had air force organizations, and licences were granted to the Argentine to build 200 Curtiss Hawk fighters. The only serious rivals to the Americans at that time were the Italians, who did a brisk business with some of the smaller countries, while a few German trainer designs met with some success.

The Italian Caproni company went so far as to establish a factory in Peru, in May, 1937, but this produced only half the proposed 25 Ca.100 trainers in the stipulated two-year period, and these at a cost considerably in excess of estimate. Both Argentina and Brazil, however, built Focke-Wulf Stieglitz and Weihe trainers in substantial numbers.

The repercussions accompanying the start of World War II reached throughout Latin America, and one of the first results was to accelerate the granting of autonomy to Brazil's air force, at a time when only the R.A.F., among the major countries of the World, occupied a similar status. The army and naval air services in Brazil were combined on January 20, 1940, as the *Fôrça Aérea Brasileira*, which was to play an operational part with the Allied forces during the War.

Some of the Latin-American countries, however, were still preoccupied with events nearer home, and in 1941 a large-scale war, in which aviation took a prominent part, broke out between Peru and Ecuador. With its modern American and Italian equipment, including Caproni 114 and North American NA-50A fighters, and Douglas DB-8A-3P bombers, the Peruvian Air Force established an air superiority against obsolescent Ecuadorean machines which did much to inflict a rapid and decisive defeat on the invaders. A particularly interesting feature of the campaign was the employment of paratroops by the Peruvian forces, which were dropped from Caproni Ca.111 transports, to capture the enemy arsenal at Puerto Bolivar.

As the United States moved towards the larger War, it entered agreements with some of the Central and South American Republics, including Cuba, Ecuador, Guatemala, Mexico, Uruguay and Venezuela, for the establishment of training and operational bases in these countries. In return, Lend-Lease facilities were extended by the U.S., and included military aircraft and advisory missions for the national air forces.

Some of the Republics took a considerably more active part in World War II. Aircraft of the Venezuelan Military Aviation Regiment co-operated with Dutch and British units in the anti-submarine defence of the Netherlands West Indies, while on May 29, 1942, when Mexico declared war on the Axis powers, bases there were made available for training many thousands of U.S.A.A.F. aircrew. Two new flying schools were also established, with the help of the U.S.A.A.F., which provided North American AT-6s for training Mexican Air Force pilots.

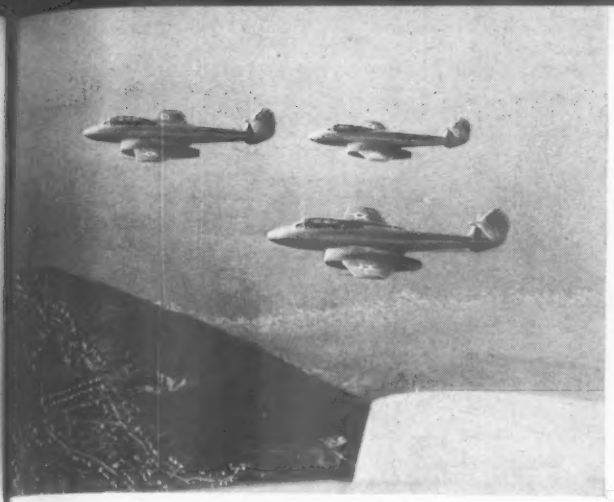
TACTICAL TRANSPORT—Early in 1958, the Venezuelan air force took delivery of the first of 18 Fairchild C-123 Provider assault transports.

Aircraft equipment received by Mexico included Douglas A-24s and Vought - Sikorsky Kingfishers, which were used for anti-submarine patrols over the Pacific and the Gulf of Mexico, while operational training was completed on Republic P-47D Thunderbolts by a Mexican fighter squadron. This was due to depart for the south-west Pacific, to serve alongside a U.S.A.A.F. unit at the time of Japan's capitulation in 1945.

It was left, therefore, to Brazilian military aviation to play the most active part among the Latin-American countries in the second World War. Anti-submarine patrols had begun before Brazil entered the War against the Axis, on August 22, 1942, and the Brazilian Air Force was subsequently assisted with these from its bases by U.S. units. Air transport staging posts were also provided, for South Atlantic ferrying, and with U.S. technical assistance the air force was entirely modernized.

Many combat and training aircraft were received and the production of Ranger aero-engines was started simultaneously with Brazilian construction of Fairchild PT-19 airframes, for which they were required. Training was provided, to operational level, on Republic P-47D Thunderbolts in the United States for a squadron of Brazilian fighter pilots and technicians between January and October, 1944. In the latter month, the unit arrived in Italy, where it began operations with the U.S. 12th Air Force, principally on ground attack duties, which it continued until V-E Day.

In the Argentine, which remained neutral, U.S. preoccupation with the War prevented re-equipment of both the operational squadrons and training establishments. The indigenous aircraft industry was therefore expanded to remedy these shortcomings,



BRAZILIAN TRAINERS.—A substantial number of Gloster Meteors were procured by Brazil in 1953, including several Mk. 7 dual-control trainers.

and to produce original designs built largely of non-strategic materials. This it did with some success, producing aero-engines in addition to trainers, light bombers and a troop-carrying glider.

At the same time, the status of the Argentine military aviation service evolved into an autonomous organization, in 1944, although the naval air units remained under the control of the maritime service. Following this reorganization came an ambitious re-equipment programme, which the end of World War II allowed full rein. The British industry was well favoured by Argentina, orders being placed in 1946-47 for 20 Avro Lincolns, 50 D.H. Doves, 30 Bristol 170s and 20 Vickers Vikings, which were supplemented by 100 Fiat G.55 fighters from Italy, and assorted transports and trainers from the United States.

Argentina was also the first foreign purchaser of the Gloster Meteor, no fewer than 100 F.4s being ordered, and yet another large procurement item from the U.K. was the total of 200 Percival Prentice trainers. The Argentine air force thus became easily the most powerful and well equipped among the Latin-American countries, and its tactical welfare was appropriately placed in the expert hands of General Adolf Galland, the former fighter chief of the German Luftwaffe.

He was employed as special adviser from 1947-1954, during which the air force was grouped into Defence, Tactical, Strategic and Air Transport commands. German influence was also felt in the Argentine aircraft industry, which produced six prototypes of the Pulqui swept-wing jet fighter designed by Kurt Tank, former chief of the Focke-Wulf company.

After the overthrow of President Peron, further re-equipment of the air force in Argentina was limited, particularly by foreign currency shortages, although the decision had been made to import most future military aircraft rather than build them locally. A request for 36 Sabre 6s was vetoed by the Argentine Central Bank, and no new operational types have been procured to replace the veteran Meteors. Beech Mentor trainers have been assembled at Cordoba, together with French-supplied Morane-Saulnier Paris jet liaison aircraft.

Only the Argentine naval air service has received more modern combat equipment, in small quantities, during recent years. Ten Corsair fighter-bombers arrived from the U.S. in 1956, followed later by six Lockheed Neptunes. The former R.N. carrier "Warrior" has been bought by the Argentine Navy, but only obsolescent aircraft are in service to equip it.

Post-war air development in the other Latin-American countries has been relatively uneventful. U.S. attempts to organize collective defence in 1947 resulted in the Rio Pact which had as signatories Bolivia, Brazil, Colombia, Cuba, Ecuador, Guatemala, Honduras, Nicaragua, Peru, Salvador, Uruguay and Venezuela. Membership of this pact automatically brought equipment and technical advice under the mutual aid programme, and most of the subscribing countries received substantial quantities of such American war-surplus aircraft as P-38 Lightnings, P-47 Thunderbolts, P-51 Mustangs, B-25 Mitchells, C-45 Expediters, C-46s, C-47 Dakotas, PBY-5A Catalina amphibians, T-6 Texans and PT-17 trainers. Naval air units have been supplied with F6F Hellcats, TBM Avengers, G-21 Goose amphibians and other obsolescent types.

Since then, relatively few of the Latin-American countries have maintained air forces of any magnitude, and U.S. aid has been renewed in very limited quantities. Newcomers like Dominica, which started an air force in World War II, and bought British as well as American surplus aircraft after 1945, are in a similar position to most of the other small countries in operating obsolete equipment, although this island Republic did procure some early Vampire fighter-bombers from Sweden.

As the most important South American signatory to the Rio Pact, Brazil has not maintained its air forces to the latest possible level of equipment, although it did procure 62 Meteor 8 fighters and 10 Meteor 7 trainers from Britain in 1953. With a few Lockheed T-33s, these are its only jet aircraft, but it also operates F-47 Thunderbolts, B-26 Invaders and a miscellany of second-line types. National aircraft production continues on a limited scale, the Fokker S-11 having been constructed under licence. The Brazilian Navy operates the former R.N. carrier "Vengeance," but has no ship-borne aircraft.

A few Latin-American countries have adopted the policy of keeping small air forces at a high degree of operational efficiency and procuring the latest British or American equipment available for export. In Colombia, for example, the air force, which became independent in 1943, obtained six Lockheed T-33s from the U.S. under the Reimbursable Assistance Programme in 1954. Two years later, a group of pilots and technicians were dispatched to Canada to train on and ferry back six Sabre 6s, which operate alongside F-47 Thunderbolts in a fighter-bomber squadron.

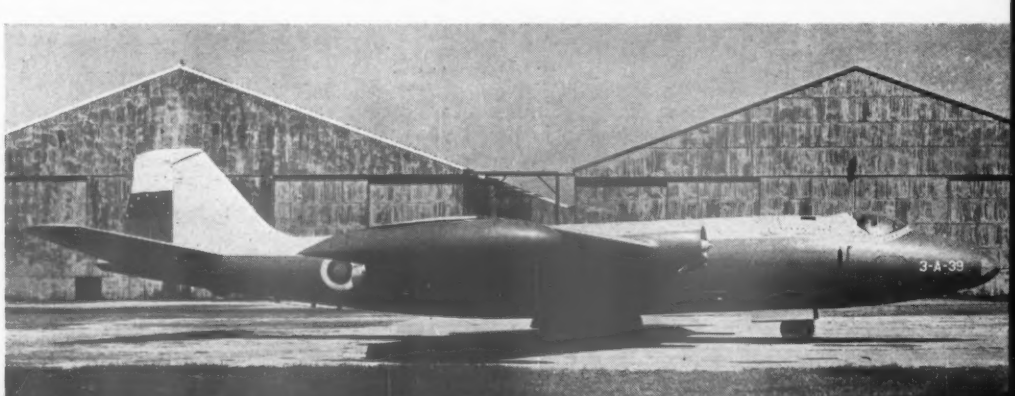
Hunters and Canberras

Ecuador, one of the smallest South American states, has a jet bomber squadron equipped with six Canberra B.6s, purchased from Britain, after the impressive tour made by a Bomber Command Canberra force. The same country also has a squadron of 12 Meteors F.R.9 tactical reconnaissance fighters, to spearhead its veteran Thunderbolts.

It is slightly surprising to find the Mexican air force with nothing more modern than similar American types, but the Peruvian air force provides a highly advanced contrast. Its operational equipment is among the most up to date in South America and includes North American F-86F Sabres, 16 Hawker Hunter F.52s, and eight English Electric Canberra B(I)8s. Supporting types include T-33s, B-25s, B-26s, F-47s, and a remarkable miscellany of vintage machines. With their low wing-loadings, docile handling and good load-carrying capabilities, from fairly small airfields, both the Canberra and the Hunter have proved very popular in Latin America.

Rivalling Peru in efficiency is Venezuela, which began equipping with jets in 1950, when an order was placed in the U.K. for Vampire 5s. This was followed by the purchase of six Canberra B.2s, and orders for Venom F.B.4s and Vampire Trainers in 1955. In the same year, delivery began of 22 F-86F Sabres and, in 1957, eight more bomber Canberras, of the Mk. 8 variety, were ordered, together with two dual-control T.4 trainers. Supporting equipment procured at about the same time included 18 Fairchild C-123 tactical transports.

Apart from coastal defence and similar duties, most Latin-American air forces have substantial transport and search and rescue rôles. Many operate helicopters and amphibians for the latter tasks, to cover some of the most savage terrain on the Earth's surface.



SOUTH - AMERICAN CHOICE.—The English Electric Canberra was chosen by the air forces of Ecuador, Peru and Venezuela to equip their bomber squadrons. Shown here is a Venezuelan Canberra B.2.

Astronautics and Missiles

Re-entry from Orbit

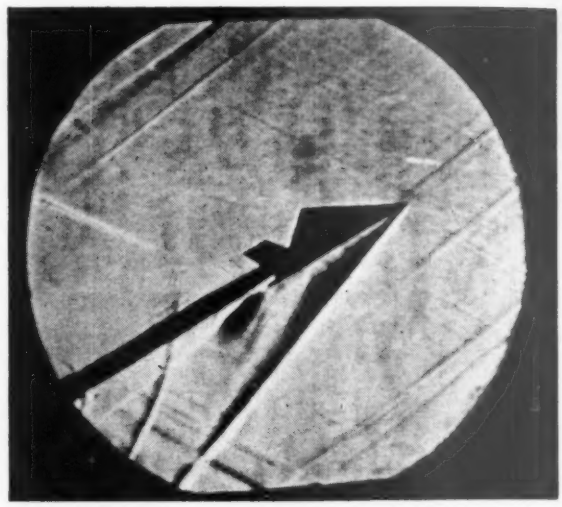
A CAPACITY audience at Filton House, Bristol, greeted Dr. W. F. Hilton, head of the Astronautics Section of the Hawker Siddeley Advance Projects Group, on January 6, when he addressed the Royal Aeronautical Society's Bristol Branch on "The Satellite Programme."

He began by breaking down a typical satellite trajectory into three parts, namely: Launch, Orbit and Recovery. However, as the shape and size of the vehicle is dictated by these latter parts of the trajectory, the usual order was reversed and the first topic discussed was Recovery.

One pound of mass in satellite motion has approximately four kWh. of stored kinetic energy and the whole of this must be converted into heat if this one-pound mass is to be brought to rest on the surface of the Earth. Consideration of an ordinary one kW. electric kettle heating less than a pint of water for 4 hr. led to the obvious conclusion that it was impossible to find a substance capable of absorbing this enormous quantity of heat.

Clearly as much heat as possible must be given to the air through which the vehicle passes, and everything possible must be done to minimize the heat absorbed by the vehicle itself. In the case of heat arising from ordinary skin friction and boundary-layer effects, approximately half of this heat appeared in the vehicle and the other half in the air behind the vehicle.

On the other hand, the conversion of energy by means of shock waves heated the air at a distance to one side of the vehicle and was basically very good. One was therefore faced with the problem of designing a vehicle to produce the maximum shock-wave drag. This would naturally make it quite unlike conventional aircraft, and would lead to some difficulties and much testing at transonic and low speeds. Such work had already been started at Armstrong Whitworth on the Hawker Siddeley "pyramid" project. (Ref. 1.)



Model of the A.W.A. "pyramid" re-entry vehicle in the supersonic wind-tunnel at Armstrong Whitworth; the lower shock wave is seen to good effect. Free-flight experiments with models of 18-in. span have also taken place to determine low-speed and landing characteristics.

Mach number M	38	34	29	24	19.2	14.4	9.6	4.8	0
Speed in miles/sec.	8	7	6	5	4	3	2	1	0
Lift/ Weight	−1.56	−1.0	−0.44	0	0.36	0.64	0.84	0.96	(1.0)

This discussion led to the question of whether to attempt re-entry with aerodynamic lift, or without aerodynamic lift. Since lift was perpendicular to the direction of motion, it did no work and did not produce heat. If a symmetrical pattern of shock waves was set up, we had a non-lifting re-entry, but if only the lower shock was present, then a lifting re-entry would result.

Unfortunately there was no fair basis of comparison between the two types of vehicle, and figures may easily be fabricated to prove either point of view. The main variables which did not correlate very well between the two types of vehicle were altitude and wing loading. Non-lifting vehicles fell to lower altitudes sooner, and wing loading had no real significance for a non-lifting vehicle, but nevertheless some estimate of structure density must be taken into account.

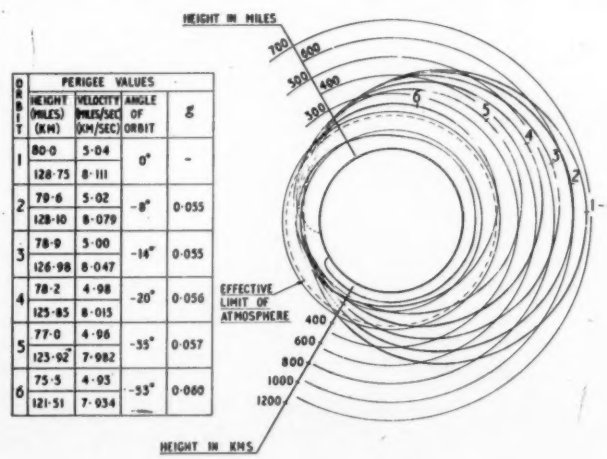
The accompanying table showing the fraction of weight, or more correctly the mass, of a vehicle which must be supported by aerodynamic lift in order to produce horizontal flight, was taken from Table 1 of the paper Dr. Hilton gave at the R.Ae.S./B.I.S. High Altitude and Satellite Rockets Symposium, July, 1957. (Ref. 2.)

It will be apparent from this table that the non-lifting re-entry vehicle does not fall like a stone, since the force of gravity only reasserts itself gradually as the satellite comes out of free fall in orbit. This phenomenon, the speaker said, may make the re-entry deceleration just tolerable for human cargo in a non-lifting vehicle of reasonable size. No such *g* problem is encountered with lifting re-entry, but there is no saving in stress factor on this account, since this is governed by take-off acceleration.

Piloted Satellite

Many human space-flights of varied durations and destinations had been planned. Dr. Hilton felt that a human occupied satellite was the gateway to success in these ventures. Once we can launch and recover human beings from satellite orbit in a reasonable fashion, longer journeys were merely a matter of extra provisions for the long journey, coupled with, say, 50% greater take-off velocity. It must always be

(*Continued on page 117*)



ORBIT	PERIGEE VALUES: HEIGHT (MILES) (KM)	VELOCITY (MILES/SEC (KM/SEC)	ANGLE OF ORBIT	g
1	80·0	5·04	0°	-
	128·75	8·111		
2	79·6	5·02	-8°	0·055
	128·10	8·079		
3	78·9	5·00	-14°	0·055
	126·98	8·047		
4	78·2	4·98	-20°	0·056
	125·85	8·015		
5	77·0	4·96	-35°	0·057
	123·92	7·982		
6	75·5	4·93	-53°	0·060
	121·51	7·934		

ORBIT	APOGEE VALUES: HEIGHT (MILES) (K M)	VELOCITY (MILES/SEC (K M/SEC)	ANGLE OF ORBIT
1	677·4	4·38	-2°
	1090·17	7·049	
2	608·7	4·43	-11°
	979·61	7·129	
3	534·2	4·49	-19°
	859·71	7·226	
4	452·1	4·55	-29°
	727·59	7·323	
5	358·3	4·63	-46°
	576·63	7·451	
6	246·5	4·72	-77°
	396·38	7·596	

Fig. 1. Re-entry without rocket braking: lift/drag ratio of 2.0; loading 12.4 lb./sq.ft.; initial height 80 miles; velocity 5.04 miles/sec.; angle of ascent = 0°; total flight time 11-hr. (Hilton).

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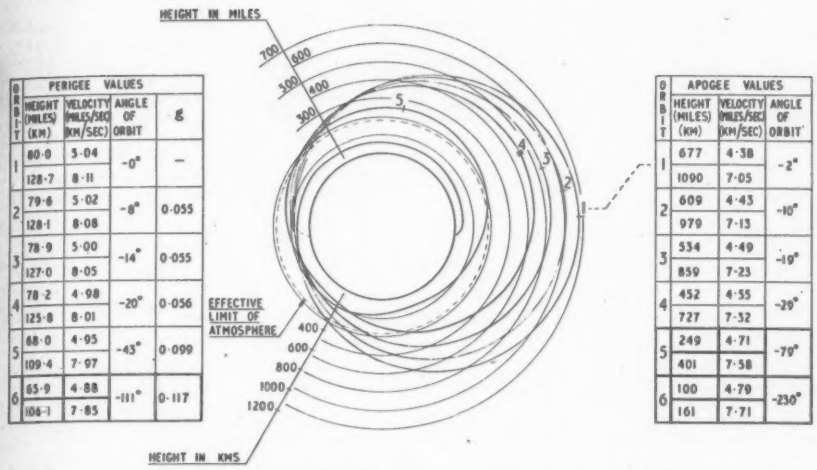


ORBIT	PERIGEE VALUES			
	HEIGHT (MILES) (KM)	VELOCITY (MILES/SEC) (KM/SEC)	ANGLE OF ORBIT	g
1	80·0	5·04	-0°	-
	128·7	8·11		
2	79·6	5·02	-8°	0·055
	128·1	8·08		
3	78·9	5·00	-14°	0·055
	127·0	8·05		
4	78·2	4·98	-20°	0·056
	125·8	8·01		
5	68·0	4·95	-43°	0·099
	109·4	7·97		
6	65·9	4·88	-111°	0·117
	106·1	7·85		

ORBIT	APOGEE VALUES		
	HEIGHT (MILES) (KM)	VELOCITY (MILES/SEC) (KM/SEC)	ANGLE OF ORBIT
1	677	4·38	-2°
	1090	7·05	
2	609	4·43	-10°
	979	7·13	
3	534	4·49	-19°
	859	7·23	
4	452	4·55	-29°
	727	7·32	
5	249	4·71	-79°
	401	7·58	
6	100	4·79	-230°
	161	7·71	

Fig. 2. Effect of firing a retro-rocket at end of fourth orbit; lift/drag ratio of 2.0; loading 12.4 lb./sq. ft.; initial height 80 miles; velocity 5.04 miles/sec.; angle of ascent=0°; total flight time 8-hr. 54-min. (Hilton).

(*Continued from page 116*)

remembered that Mars was at least 160 times farther away than the Moon—like comparing the journey from London to Bristol with one to Australia, he said.

This led to a very interesting philosophical argument as to the best orbit for early human spaceflight. We must compromise our desire to explore great altitudes with the existence of the van Allen radiation belt, Dr. Hilton continued. While true space travellers may have to take off from the magnetic poles (Canada for the Western World and Antarctica for Russia?), or even go swiftly upwards through this region from bases already in existence, a piloted satellite vehicle would have to keep below, say, 700 miles if the human cargo was to avoid radiation troubles.

Having thus set a maximum height, or apogee, what lowest height, or perigee, should be used? A circular orbit at 700 miles had two disadvantages—it did not permit observations at various altitudes, and it was horribly permanent if the retarding rockets should fail to function and, in consequence, fail to initiate re-entry.

Accordingly, the perigee or lowest altitude of the ellipse had been set at 80 miles. This would ensure ultimate re-entry for the Armstrong Whitworth "pyramid" vehicle after six circuits of the Earth, without use of the retro-rocket for braking.

A lift/drag ratio of 2 was assumed in this calculation, and the orbits are shown in Fig. 1. Fig. 2 shows the effect of firing the retro-rocket ($g/20$ for 15 seconds or g for 0.75 seconds) at the end of the fourth circuit. Fig. 3 shows the same flight plan, but using L/D=1 when attempting re-entry, in order to reduce heating effects on the vehicle. This had a very marked effect and reduced flight time by two hours.

Hence we see the real advantage of a lifting re-entry vehicle, said Dr. Hilton. The shock-drag which dominates the retardation can be varied by altering angle of incidence, in accordance with well-known laws.

The zero-lift vehicle had to alter its geometry to bring about a similar effect, as does for example the Avco "umbrella" drag-brake re-entry vehicle (Ref. 3). This may be more difficult to accomplish. The lifting vehicle, he stressed, could also be rolled to pull it off course and to effect a landing to one side of the plane of its orbit.

Finally, the speaker came to the question of launching of the "pyramid" satellite, which weighs two tons. This was about double the weight which could be put into orbit by a Blue Streak/Black Knight combination. These existing rockets might, however, be adapted for unmanned scale satellite tests and also for full-size manned vehicles which just fail to get into orbit.

A launching weight of 160 tons was required and the first stage would weigh 133.5 tons, including 120 tons of propellents having a specific impulse of 270 sec.

Burn-out would occur at 40 miles and 9,700 ft./sec. The second-stage weight of 22.07 tons would include 19.85 tons of propellent, giving 21,000 ft./sec. at 75 miles. The third stage was designed to carry on into orbit.

It was realized that these rockets do not exist, but it was always important to investigate and if possible to agree, as to our aims, before making those compromising adaptations of existing hardware, for which the British are renowned.

In conclusion, Dr. Hilton showed a film starting with an external shot of the Martin factory at Denver, taken during the lecturer's recent "astronautics" tour of the United States. Security prevented interior views being obtained, but the huge scale of this predominantly space-flight venture was apparent, in contrast to the laudable but necessarily limited British effort at Hawker Siddeley, which showed free flight and wind-tunnel testing of models of the Armstrong Whitworth "pyramid" vehicle. Finally, Dr. Hilton presented an interesting animation of a satellite on an elliptical orbit round a rotating Earth, in true scale, both for time and distance. This established clearly the manner in which a satellite "swoops" past the Earth at perigee and travels very slowly at the corresponding path at apogee, tracing out equal areas in equal times as propounded by Kepler several centuries ago.

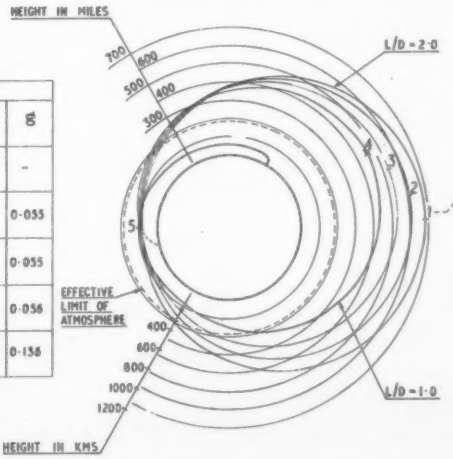
Discussion

Numerous questions followed the lecture and film show.

MR. FARRAR expressed interest in the 4kWh. per pound heating and asked what rate of heating was anticipated at the worst, to which the answer was 6kW./sq. ft. He also elicited the information that heating ceased to be a problem at wing loadings below 2 lb./sq. ft. The lecturer remarked that such structures seemed too fragile for general use.

Mr. Farrar went on to say that the 8g experienced by non-lifting vehicles when hot was much more serious to their structure than a similar acceleration during the ascent, taken when cold. The lifting vehicle has to make an error of 20 times too much rocket braking to get into 8g pull-out in a skip.

Answering Mr. Farrar's question on cosmic re-entry, Dr. Hilton stressed the need for accurate navigation when remote from the Earth, to distinguish between useful re-entry 50 miles above the Earth, and futile near-misses at 80 miles and above, resulting in the vehicle describing the other half of the hyperbola, ending up at infinity. He also stressed the need for inverted flight above seven miles/second, as shown in the table given in the lecture. The time taken and the path flown by the pilot from seven down to five miles/second were entirely free



ORBIT	PERIGEE VALUES			
	HEIGHT (MILES) (KM)	VELOCITY (MILES/SEC) (KM/SEC)	ANGLE OF ORBIT	g
1	80·0	5·04	0°	-
	128·75	8·111		
2	79·6	5·02	-8°	0·055
	128·10	8·079		
3	78·9	5·00	-14°	0·055
	126·98	8·047		
4	78·2	4·98	-20°	0·056
	125·85	8·015		
5	70·0	4·90	-43°	0·138
	112·7	7·89		

ORBIT	APOGEE VALUES		
	HEIGHT (MILES) (KM)	VELOCITY (MILES/SEC) (KM/SEC)	ANGLE OF ORBIT
1	677·4	4·38	-2°·
	1090·17	7·049	
2	608·7	4·43	-11°
	979·61	7·129	
3	534·2	4·49	-19°
	859·71	7·226	
4	452·1	4·55	-29°
	727·59	7·323	
5	97·8	4·77	-176°
	157·4	7·68	

Fig. 3. Effect of firing a retro-rocket at end of fourth orbit; lift/drag ratio of 1.0; loading 12.4 lb./sq. ft.; initial height 80 miles; velocity 5.04 miles/sec.; angle of ascent=0°; total flight time 7-hr. (Hilton).

from worry as to fuel, duration or kinetic heating problems, and could be varied within very large limits to suit individual pilots.

MR. TONKIN asked about the effect of a slight error of height in the 80-mile altitude chosen for the perigee of the pyramid's orbit. Dr. Hilton explained that each pass through the atmosphere caused a definite loss of speed, and when the speed went below the circling speed of 4.88 miles/second, re-entry took place. Altitude played a minor part in this, and small errors would be unimportant.

Questioned on the ion rocket for interplanetary travel, the lecturer emphasized that the huge weight of electrical generating plant needed would completely mask the very good specific consumption. In any case the generation of electrical power by cheap lightweight plant would interest the Central Electricity Board very much more than anyone else, the lecturer thought.

Asked about the reliability of rockets in relation to human flight, Dr. Hilton replied that many successful aeroplane flights involved a pilot's decision to wind down the wheels by hand, or some such manual operation, in the absence of automatic operation. How many recent rocket failures would have been saved by a pilot?

On the other side of the picture, self-destruction devices were needed in unmanned rockets. In one instance these had been actuated in error by a woman taxi driver using a radio-phone many miles away.

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(2) W. F. Hilton, "Recovery after re-entry, by the use of aerodynamic lift," contained in the Proceedings of the joint B.I.S./R.Ae.S./College of Aeronautics' Symposium, "High Altitude and Satellite Rockets," available from the Interplanetary Publishing Co.
(3) "Manned Satellites and Hypersonic Gliders," THE AEROPLANE AND ASTRONAUTICS, September 11, 1959, p. 174.

Those Communications Satellites

COMMENT by Mr. G. A. Isted, Propagation Research Group, Research Division, Marconi's Wireless Telegraph Co., Ltd., Great Baddow, on the article "Radio-Repeater Satellites" in The "Aeroplane and Astronautics," November 27, 1959:—

IT would be a disservice to science to pour cold water on the possible application of satellite techniques to long-distance radio communication, but equally it would be a disservice to the communication engineer to suggest that a revolutionary method of communication is just around the corner.

There is an undeniably urgent need to improve and expand our global communication techniques and in this radio communication, which has played an all-important part in the development of modern civilization, is long overdue for a complete overhaul.

From many points of view the last paragraph of the article is the most significant: "If artificial satellites can be made sufficiently reliable and long-lasting, future expansion of communication services may take place in space rather than under the sea." While every encouragement must be given to the proposed system it must first be demonstrated that a satellite can be brought completely under control on a 24-hour orbit and that stable radio retransmissions, free from deleterious propagation effects, can be received from it before too much thought is given to system adaptation.

In the article some emphasis is laid upon the possibility of exchanging intercontinental television programmes but, in this connection, it should be noted that the difference in local peak viewing hours is a deterrent to sustained simultaneous "Mundovision." Furthermore it is difficult to visualize a frequent need to televise a programme of such global importance that the situation could not be met satisfactorily by telerecording the programme on magnetic tapes and flying them by fast aeroplane to different parts of the World for convenient viewing.

It should not be forgotten that our civilization has not yet reached the stage where the peoples of the World accept wholeheartedly the principle of freedom of speech, consequently some governments endeavour to control, by selective jamming, the international programmes available to the people everywhere. How much easier it would be to jam a satellite repeater system for the same purpose and without much fear of detection! Strategically, the system would probably be the most vulnerable ever conceived from the jamming and interception point of view, and it is therefore unlikely to find much favour in military circles.

Factually the article can be criticized. For example, it is stated that the I.T.T. Laboratories estimate that a global satellite system operating 48 channels would cost about £240 per channel/mile while a 500-channel system would cost only about £20 per channel/mile. Somewhere in between these figures, the article states, lies the cost of the submarine cable. Clearly the satellite and cable systems are not directly comparable because, in the foreseeable future at any rate, the satellite system would require a recurrent replacement expenditure; the cable, on the other hand, after the first capital cost would require only moderate expenditure for maintenance.

The point made in the article that existing transatlantic cables are expected to reach their capacity in the 1960s has a positive solution by the simple expedient of laying more cables.

The present state of the art does not appear to permit the setting up of a high-capacity radio communication system on the grand scale envisaged in the article; scientists and engineers would be well advised to apply themselves to a sober development of the system without attempting to bring about a sudden and spectacular change in the radio communication situation. In the meantime it would be wise to consider how our present communication techniques could be further exploited or improved upon because it is unlikely that the demand for radio services as we now know them will suffer any diminution for many decades.

REPLY by Mr. Kenneth Gatland, who gives some additional information on contemporary developments:—

THE article, "Radio-Repeater Satellites," was intended to draw attention to the very serious considerations which are now being given to this subject in the United States, certainly not to minimize the difficulties of establishing a commercially useful satellite communications system, which will obviously take many years. This, as we have already observed, will demand above all else, high reliability and long life of both satellite and its electronics.

Our concern is rather lest the British electronics industry may be denied the opportunity of participating in this advanced field of research and development because, as yet, no programme exists for the development of our own satellite launching vehicles. It was therefore interesting to hear Mr. Duncan Sandys, at the R.Ae.S. luncheon on January 12, draw attention to the prospects of using Earth satellites "as passive reflectors of radio signals or as relay stations for a large number of channels for telephonic communication or television." One was most interested to learn that, in the Minister's opinion, this was a problem to which the British industry "might well address its mind."

Meanwhile, across the Atlantic, interest in communication satellites is growing apace. There are currently four communication satellite projects which have progressed beyond paper studies. These important projects are Echo, Courier, Steer and Decree.

Echo is a 100-ft. inflatable satellite for passive communication experiments to begin this spring. Such satellites will have an inflatable structure of .0005-in. thick Mylar plastic, coated with vapour-deposited aluminium to provide a radio-reflectivity of at least 98% up to frequencies of 4,000 megacycles per second.

Courier, a 500-lb. delayed-action repeater satellite, is also scheduled for launching this year. This satellite is expected to transmit six million items of information in four minutes, and will provide—according to the Army Signal Corps—20 continuously available 100 word/min. teletype channels. As the satellite passes over one ground station, it will be commanded to transmit information "addressed" to that station. Simultaneously, the satellite will be able to receive and record, for later transmission, communications for other stations in the network.

Steer is a polar orbiting instantaneous repeater, whereas Decree is an equatorial 24-hr. orbit instantaneous repeater.

The latter is bound up with the NASA Saturn space-booster and is not expected to materialize for some years. It is expected that an active 24-hr. satellite can eventually be produced with 300 voice-channels, or two TV channels. The planned operating frequency will probably be some 2,000-2,300 mc/s with an output of 150 watts. At present, the estimated payload is 8,000 lb., but this may be reduced in development. An earlier project is likely to be a 625-lb. satellite with 144 voice channels operating on a frequency of 2,000 mc/s with an output of 20 watts.

Needless to say, in the development of the 24-hr. equatorial satellite, much attention is being paid to the problem of keeping the orbiting vehicle on station with the minimum expenditure of energy. Atomic batteries are being developed for long-life power supply, and high reliability† is being sought in circuit duplication and other techniques.

The disparity in time between various TV-watching communities is naturally pertinent to the problem of developing a global television service, but "canned" TV can never be a lasting substitute for the "live" variety. One has only to think of the impact of global television in sport, for example. One ventures to suggest that a sustained commercial TV service is not essential to the success of the system.

The estimates quoted in the article, contrasting the cost of possible repeater satellites with that of conventional underwater cables, were obtained from a feasibility study recently published in the United States. In the present early stage of development, as Mr. Isted points out, the need to replace satellites at intervals is naturally a disadvantage, but already there are hopes of maintaining elementary communication satellites in operation for a year or more. Once first costs are met, Space Electronics Corp. consider that the orbiting of additional units could be accomplished within reasonable economic limits, but obviously there is much need for improvement in this direction.

Looking still further ahead, there is the prospect that, when boost-gliders of the Dyna-Soar type are fully developed, these orbiting repeater stations can be serviced in orbit. It may be noted in this context that NASA are devoting considerable sums ($3 million during 1960) to studying the problem of achieving a rendezvous while in orbit—but no one is likely to suggest that these things will come about tomorrow. However, by the end of the present decade we may begin to see tangible results.

†On the question of reliability, it is of interest that the "orbital laboratory" Sputnik III has now been radiating signals for more than 1½ years.

Spaceflight's Fourth Year

STARTING on its fourth year of publication is the British Interplanetary Society's magazine *Spaceflight*—a truly pioneer venture, for the first issue appeared in October, 1956, a whole year before Sputnik I went up. Till then the B.I.S. had only its *Journal*, which started publication in 1934, within a year of the Society's formation, and was revived in 1946 in the format of a respectable scientific journal—justifiably so, considering how often it has to be quoted in the literature of astronautics and rocketry.

But as astronautical science went ahead, more and more of the *Journal*'s contents became incomprehensible to the non-technical reader, so *Spaceflight* was started as a quarterly under the editorship of Patrick Moore, the well-known astronomical writer and broadcaster, supported by an editorial board to advise on other subjects. Among eight articles in the first number was an exhaustive description of the Vanguard Project, taking up one-third of the whole issue. Just over a year later there was an introductory article "The Space Age is Here," followed by descriptions of the first two Russian satellites—and two inches of column on the failure of the first Vanguard launch.

The editorship of *Spaceflight* has now been taken over by Kenneth Gatland, the B.I.S. vice-chairman. Patrick Moore, though too busy to carry on editing any longer, has nevertheless found time in the latest issue to give his views on sending experimental animals into space: "Unlike the so-called sportsman with his pack of hounds," he concludes, "the scientists never cause unnecessary pain."

Spaceflight, like the Society's *Journal*, is now, in turn, finding itself quoted in scientific publications. The only matter for regret is that its circulation—at least in this country—is still confined to B.I.S. members because it would be uneconomic to put it on the general market. So would-be regular readers would be well advised to join the B.I.S.—A.E.S.

Mr. Khrushchev's Armoury

FOLLOWING the announcement that a new Soviet space-booster would shortly be test-fired over the Pacific Ocean, Mr. Khrushchev's statement before the Supreme Soviet on January 14 that a fantastic new weapon "was in the hatching stage" did not come as a great surprise. While it is by no means certain that the two are related, or in fact that the new weapon is a missile at all, there has been speculation in the United States that it may be an ICBM of over 8,000-mile range.

Rocket weapons are now part of Soviet philosophy and it was no shock to learn that greater reliance would be placed on them in the future. "The Air Force," Mr. Khrushchev said, "is to be replaced by rockets almost completely. . . . I must say once again that the Soviet Union has accumulated so many nuclear, atomic and hydrogen weapons, so many rockets to deliver nuclear heads to the territory of a possible aggressor, that in the event of any madman's trying to attack our State or any other Socialist State, it would be able literally to obliterate from the face of the Earth an attacking country or countries.

"Though the weapons we have now are formidable weapons indeed," the Soviet leader went on, "the weapon we have today in the hatching stage is even more perfect and even more formidable. The weapon which is being developed and is, as they say, in the portfolio of our scientists and designers, is a fantastic weapon."

In this picture, a 1/15th scale model of the Chance-Vought Scout is being installed in the Unitary Plan Wind-tunnel at NASA's Langley Research Center in Virginia. Tests at air speeds of between Mach 2.0 and 4.0 are to determine the effect of fin size and second stage flare angle on the rocket's static stability.

Personal Flying

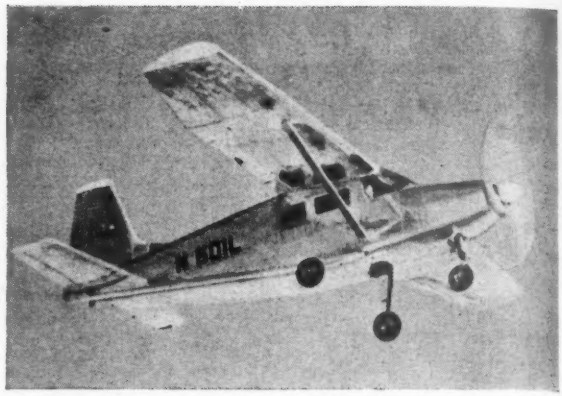
LATEST company to join the growing band of executive operators is Leyland Motors, Ltd. This Lancashire-based organization has acquired a de Havilland Dove, together with a resident pilot, which will be based at Samlesbury, some eight miles from the Leyland headquarters. For all-weather operation, the Dove is fitted with ADF, main and stand-by VHF, VOR, ILS, autopilot and de-icing.

Accommodation is provided for six passengers. Sir Henry Spurrier, chairman and managing director of the Leyland company, and a First World War pilot in Europe and the Middle East, envisages air travel as a necessity for his executives to maintain close personal contact with the Group's main manufacturing plants in the European zone. It will also provide quick and efficient transport for customers visiting the company's numerous plants.

During 1959 alone, Leyland directors and executives flew well over 1¼ million miles on business journeys throughout the World to maintain the large volume of exports which account for more than half the company's output. Leyland's airmindedness also seems to be reflected in the names of its products, its vehicles including a Super Comet, a Super Beaver, and a Meteoor for the Low Countries.

* * *

Reference to the latest Bonanza on this page last week brings to mind an illuminating example of comparative aerodynamics which may now be made between two Beech products. The Bonanza and the new Debonair have identical airframes, except for the replacement of the Vee tail on the later product by conventional horizontal and vertical stabilizers. There is a slight difference in powerplants, the Bonanza having a 250 b.h.p. Continental I0-470-C fuel-injection engine, and the Debonair, the slightly less potent I0-470-J, developing a maximum of 225 b.h.p.



BUSH BABY.—Lockheed Aircraft have re-entered the light aeroplane field with two prototypes of the Model 60 utility type, which is intended for bush operations in undeveloped parts of the World. The Model 60 has a 260 b.h.p. Continental 10-470 engine and may be built in Mexico and Italy.

There is also a small accompanying difference in gross weights, the Bonanza being 50 lb. heavier at 2,950 lb. all-up. The interesting thing is that figures for the two types show that the M35 Bonanza cruises at a T.A.S. of 200 m.p.h. on 53% power (132.5 b.h.p.) at 12,500 ft., whereas the Debonair returns 180 m.p.h. T.A.S. at 65% power (146 b.h.p.) at 11,000 ft.

This puts the Bonanza no less than 20 m.p.h. up for the expenditure of 13 or so less b.h.p., which appears to provide an unanswerable case for the Beech decision, in 1947, to adopt the Vee tail. Its abandonment in the Debonair is presumably due to the need for economy in the lower cost aircraft.

Gliding Notes

by Dr. A. E. Slater

LAST week the new aviation "barrier," established by Dr. Raspet specially for sailplanes, was mentioned in these columns. Going on from where the notes stopped, Dr. Raspet says that turbulence in "the earth's boundary layer" has a peak frequency of about one "cycle" per second. However, a sailplane does not have to change its longitudinal attitude as frequently as that in order to extract energy from once-per-second gusts.

In fact, Raspet claims, "For energy to be gained by an aircraft flying through a turbulent air mass, the sailplane must merely hold a fixed longitudinal attitude." It must therefore be given neutral stability by, for instance, installing a weight which can be moved back to bring the machine's centre of gravity to the neutral point.

Presumably one moves the weight back for each straight glide from one thermal to the next, when, Raspet points out, the effect of any turbulence would then be to flatten the gliding angle. However, the advantage might not be as much as he appears to hope for, because most of the turbulence on thermal days is concentrated around the thermals and inside them, particularly their outer parts, while the air between the thermals is comparatively smooth, except in extremely rough weather. It might be better to fly straight ahead through all but the biggest thermals, to get the best advantage from turbulence.

* * *

LANDING after sunset at the end of thermal flight has been done by others besides Mr. P. K. Banerjea, whose feat at Delhi was described in these Notes on January 1. Sqn. Ldr. T. J. Page reminds me of an article of his in *Gliding* for Summer, 1955, describing a thermal flight at Karachi by Mrs. Mikulski, who, as Miss Younga, was Polish woman champion before the War, and whose husband, also a former Polish gliding champion, joined the Pakistan Air Force.

* * *

On November 24, 1954, Mrs. Mikulski soared over Karachi for 6 hr. 6 min., starting at 12.18 and landing 42 minutes after sunset, which was at 17.42. During daylight she kept between 4,000 and 5,700 ft., but after sunset she found a large area of lift at 2,000 ft. The sea breeze came inland from the coast seven miles away but, Sqn. Ldr. Page says, "did not advance very far inland" that day. But at 15.00 hrs. it brought a change of wind which persisted till after sunset, so there could have been a quasi-stationary sea-breeze front, perhaps maintained by the accumulated heat of Karachi's buildings.

Similar post-sunset landings are reported from Salisbury, Rhodesia, where thermals cease at low level at 16.30. The gliding club members have found that, by launching at 15.00 hrs. and climbing up to cloud base at about 12.000 ft. a.s.l., it is possible to prolong the final descent to such effect that a flare-path is needed for landing.

The expression "evening thermal," which was once on everybody's lips, has become rather discredited of late, because the appearance of a wave, facilitated by the air becoming unstable in the evening, provides a more plausible explanation. Simple arithmetic shows that hot air displaced out of a valley, or trapped in a wood, could not provide an "evening thermal" for more than a few minutes if it is to rise fast enough to keep a sailplane up.

An ingenious theory to account for "evening thermals" in hilly country was proposed by Dr. Karl Lange, one of the original German soaring pioneers who emigrated to the United States. The evening cooling does not extend very far up, and the air above it remains somewhat unstable, as it has been all day. Cooled air runs down into the valleys, leaving the hill tops in contact with this unstable air, and it only needs to be lifted a little, by the wind drifting it over a hill, for the instability to be "released"; so there is your evening thermal.

* * *

SOMEONE who addressed a Christmas card to me at "THE AEROPLANE, Chancery Lane, London," showed further signs of confusion by signing himself illegibly. There is one clue: *The Sailplane and Glider* was published in Chancery Lane from 1932 to 1934. It was also printed in Chancery Lane for its first year of life.

* * *

BETSY WOODWARD, who put up the World's feminine height record of nearly 40,000 ft. in California, is over in England for a second spell. Last time she was working on the structure of thermals for the Imperial College Met. Department. This time she is doing similar work, but under the auspices of the U.S. Army; she will be making a great number of traverses through British thermals with a view to finding the temperature distribution, in addition to the distribution of vertical motions, which has already been investigated and incorporated into a "model" resembling a vertically elongated smoke-ring.

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AUSTRALIA CHOOSES BLOODHOUND

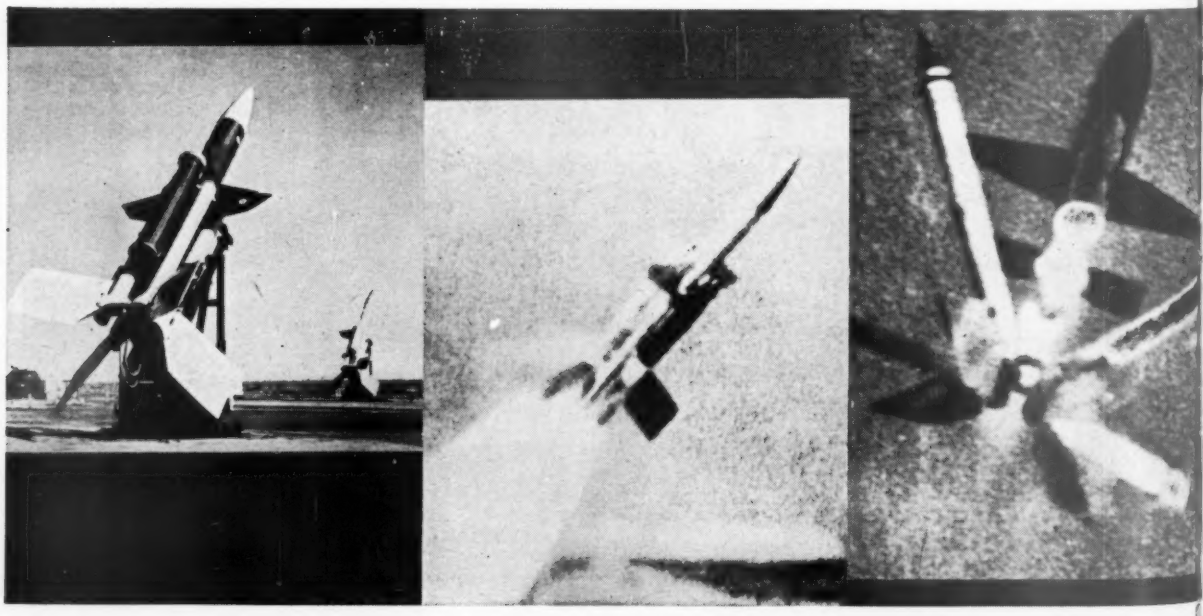
for defence

Australia's decision to order the Bloodhound, announced on the 26th November, is further proof that this weapon system is recognised as a most effective defence against air attack.

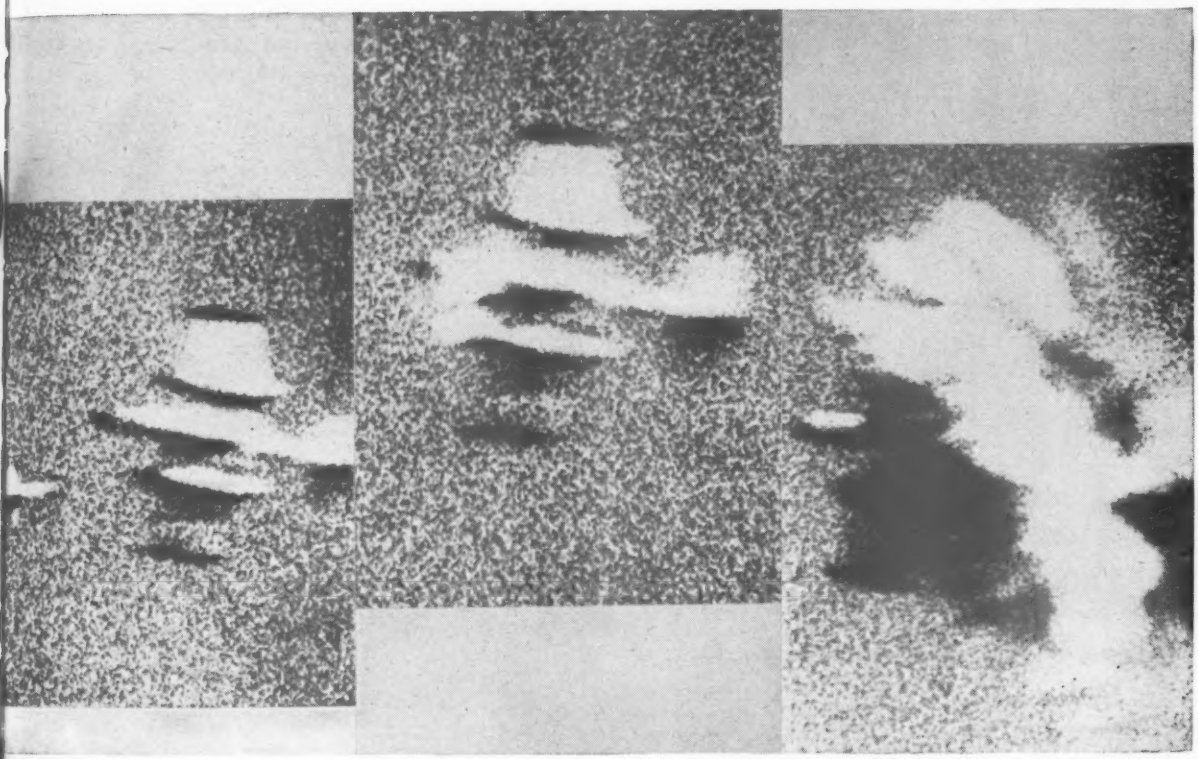
Missile mounted on launcher ready for firing.

The missile launched by boost rockets.

Rockets jettisoned; Missile now supers... further accelerated by ramjets.



Missiles readily transportable; rapid installation on site.



...ile homes on to target; semi-active ...ance system ensuring highest accuracy.

Missile closes in; moving wing control counters any evasive action target takes.

Missile gets within lethal distance; proximity fuse detonates warhead — target destroyed.

HOW BLOODHOUND PROVIDES FOR DEFENCE

Power. The Bloodhound is powered by two Bristol Siddeley ramjets. The ramjet is the simplest air-breathing engine yet devised. It has no moving parts, is safe and simple to handle, and provides power and range flexibility.

Homing System. The semi-active homing system consists of a ground-based radar which illuminates the target which in turn reflects the radar signals back to a receiver in the Bloodhound. Thus missiles may be fired singly or in salvoes, since they can share the reflected radar signals.

Airframe. The airframe employs a monoplane moving wing configuration which provides quick and precise response and gives accuracy of interception at high altitudes.

BLOODHOUND — built by Bristol for more effective defence against air attack

BRISTOL/FERRANTI

Bloodhound

GUIDED WEAPON SYSTEM

WEAPON DESIGN AND CONSTRUCTION BY BRISTOL · GUIDANCE AND CONTROL BY FERRANTI
TARGET ILLUMINATING RADAR BY AEI. SYSTEM SALES ORGANISATION BY BRISTOL AIRCRAFT LIMITED

There was Desoutter down at Hendon making pneumatic power tools and there up at Wolverhampton was Lang Pneumatic making the cylinders, valves and what-nots needed to control them. So what was more natural that the two should come together and provide *complete* power installations for Industry? All that was needed to join them up was a simple footpath. Nobody asked for a 72-mile motorway costing £21,000,000. After all, they only use it twice a day when they take the tea up.

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CRC 324

Correspondence

The Great Crossings

I HOPE, and expect, that this will be only one of many letters to be received in your office commenting on the words in John Fricker's article in No. 2514, Volume 97, of THE AEROPLANE AND ASTRONAUTICS published on December 25 last, "Lindbergh . . . the first transatlantic crossing in the 'Spirit of St. Louis'" (see last paragraph on page 660).

It took the British aviation fraternity more than three decades to erect a suitable memorial to the first non-stop crossing of the Atlantic by a British aeroplane manned by a British crew of two. No doubt THE AEROPLANE played its part in getting this done, and it is therefore lamentable that it should allow such a distortion of the truth to appear in its pages.

The only consolation for the fact that this part of the article will be widely read in America, and will serve to confirm the erroneous convictions of many of our transatlantic friends, would be if this letter and many others like it, could also be published in your otherwise estimable journal, thus serving to correct those aforesaid erroneous impressions.

London, S.W.1. R. C. KEARY
(Group Captain, R.A.F.).

[Gp. Capt. Keary need have no fear that we have forgotten the great British "first" by Alcock and Brown who crossed the North Atlantic eastwards in June, 1919, in the Vickers/Rolls-Royce Vimy nor that by Capt. Scott in the airship R.34 who made the double crossing with more than 30 persons in July of the same year. We are sorry that the inadvertent omission of the qualifying word "solo" should have roused any kind of misgivings.—ED.]

The Calculated Risk

YOUR correspondent H.A.T. has quoted an article which appeared in *The Log* in your January 1 issue and although I am extremely reluctant to get involved in this matter I feel that, in the interest of accuracy, logic and common sense, I must comment on this extract.

Firstly, the original article does not quote the instances cited as "the prospectively dangerous peculiarities of the flight deck"—this appears to be an insertion by H.A.T. in an endeavour to prove his point. In fact the writer in his preamble states: "For all (these peculiarities), there may be a good reason"; he had not, unfortunately, taken the trouble to find out if this statement was true and I shall now try to show that it was.

(i) The fuel heater switches are labelled open-shut for the very good reason that this is exactly what the movement of the switches does—opens or shuts the fuel heating valve by means of an actuator, to a desired position, the results of this movement being clearly shown on the adjacent temperature gauge.

(ii) The emergency lever on the red system is primarily a hydraulic system selector lever—conventionally UP for "ON," and to lower the undercarriage correctly by this system the normal gear selector lever should be selected "Down" first before applying hydraulic power.

(iii) The yellow system light does *not* show that the yellow system is operating satisfactorily; this is shown by the system pressure gauge. The light is clearly marked "Light ON," "Switch ON" and is to ensure, by a positive warning, that the electric hydraulic pump is not left switched on when not required.

It was introduced as a result of experience showing that such a reminder was in fact necessary.

I could go on in this vein explaining the majority of the points raised in *The Log* article but space obviously would not permit this. I would, however, like to make a few short comments on the conclusions.

1. The statement made in this conclusion would have stifled the majority of the progress that has been made in the past. For instance, we should now have no retractable undercarriages, no jet engines, no pressurization, no air-conditioning, no hydraulics, no AC electrics, no jet aircraft—and this list can continue to be enlarged. To suggest that those responsible for design set out "to design a new inferior system" is quite obviously absurd.

2. "Subconscious" pilots are either dead or highly dangerous.

3. It would appear that what is natural to a large number of pilots is not so to *The Log* writer. Natural sense controls, unambiguous instruments, and a standard set of conventions are continually in the forefront of the designer's mind—unfortunately, the perverse ingenuity of man frequently nullifies all the efforts in this direction.

4. Systems are kept as simple as possible commensurate with safety. I am unable to understand the meaning of this conclusion. How can a hydraulic, pneumatic, air-conditioning, or electric system, just to mention a few, "revert to basic"?

5. "Leave room on the flight deck for the pilot (always assuming the aircraft needs one)" defies comment.

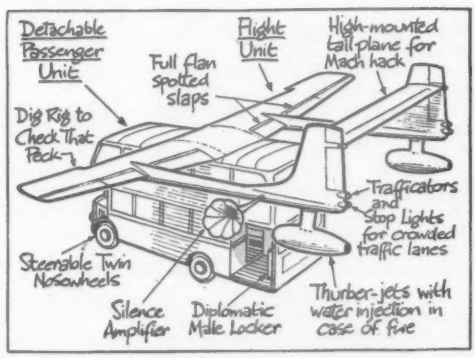
Dorney Reach, Bucks. A. P. W. CANE.

[H.A.T. writes: "For the benefit of those who do not see the BALPA journal it should be explained that the writer of the mildly but constructively critical article in *The Log* (from which the quotations were extracted) was trying, amongst other things, to show that even the best of aeroplanes has flight-deck peculiarities. He was also pointing out the difficulties arising from variations between the systems used in different aircraft. In my turn I was using the quotations to emphasize the fact that the dangers of Murphy's Law apply on the flight deck just as they apply anywhere else.

"The implications of a literal interpretation of Capt. Cane's reference to subconscious action might also be said to 'defy comment.' With respect, I ask him to imagine the frantic situation on flight decks if pilots had to think as consciously about all their actions as they did during their first few hours of *ab initio* and instrument-flight training—or as they would need to do if throttle movements were, for instance, to be reversed by ICAO agreement."—ED.]

Groundabout

The Omniliner. Up at Hatfield, Philip Tomkinson, Geoff Meadowcraft and Jacqueline Wood of Engineering Sales, have devised their own airliner, the de Heavyland Guardsvan Omniliner which I have sketched here. A replacement for the Vanguard, 707, 748, 121, 999 and the 10.15 from Waterloo, it meets public demand for a transport which, by sheer ultra-subsonic performance, will give passengers much more air-time for their money. With a rather unusual break-even figure of 104½ passengers, its calculated performance is thought to be not unduly optimistic, even after allowances for the Stress


Detachable Passenger Unit
Flight Unit
High-mounted tail plane for Mach hack
Full flan spotted slaps
Dig Rig to Check That Peck
Trafficators and Stop Lights for crowded traffic lanes
Steerable Twin Nosewheels
Silence Amplifier
Diplomatic Male Locker
Thurber-jets with water injection in case of fire

Office Gloom Factor and the Weights Dept. Despondency Index. Original features include a cruise technique using 1st, 2nd and 3rd gears and overdrive; silence amplifiers to broadcast records of complete silence, completely drowning engine noise; and a wide cabin gangway for wide stewardesses.

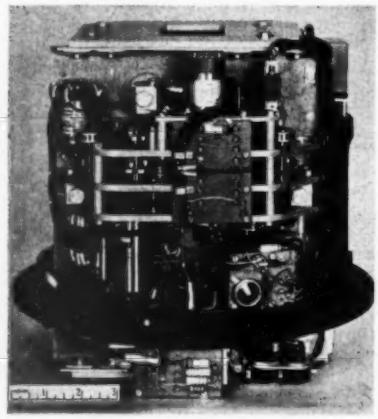
Mexico-operation. Among our Christmas cards was one from Alex Duncan, who used to be aviation manager for R. K. Dundas, Ltd., and is now well established in Mexico where he represents British interests, including the Avro company, who have high hopes of selling their 748 there. As they seek a name for their twin-Darted aircraft, Alex's card might help. The highly coloured illustration depicts "Quetzalcoatl," described underneath as "The Precious Twin Wind-God." Nice, handy name, the Avro Quetzalcoatl.

How First Can You Get? Having seen in a travel agent's window a Pan Am display with the bold device "ANOTHER JET FIRST!" I speculated on what their jet firsts might be. Since the Comet, to my knowledge, got all the *first* firsts in this line, I suppose this claim was for "The World's First Pan Am Jet."

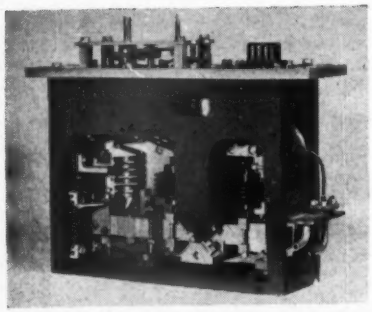
by Lorenz

NOTES AND EVENTS

NEW FLIGHT RECORDER.—At this year's Physical Society Exhibition, Royston Instruments, Ltd., of Byfleet, is showing a range of recording equipment. The first of these is the prototype of a 11-lb. sub-miniature data magnetic tape flight recorder which has been developed primarily for use in missiles. A miniature cassette-loading routine flight data recorder using magnetic tape, and line maintenance magnetic tape playback equipment from the Midas comprehensive routine flight data recording system will also be displayed.



MINIATURE POWER.—Smiths Aviation Division is to market a new size 11 hysteresis AC motor. With a mechanical output of 8 watts for an outside diameter of $1\frac{1}{16}$ in., the motor can start under full load and uses either 200-V. or 115-V. 3-phase 400 c.p.s. supply. Applications include use in electronic equipment blowers, missile programme units and airborne tape recorders.



FIRST SHOWING.—Kelvin and Hughes are exhibiting a number of new products at this year's Physical Society Exhibition. They include, left, a T.A.S. computer and, above, a miniature force balance unit.

EQUIPMENT FOR THE 188.—British Messier Ltd., has manufactured the undercarriage, and Dowty Equipment and British Messier hydraulic components have been supplied for the Bristol 188 research aircraft. Rotol Ltd., are represented in the aircraft by several ancillary units.

ULTRA CHANGES.—Two subsidiary companies are being formed by Ultra Electric (Holdings) Ltd., to undertake the future activities of the Group. Ultra Electronics Ltd., will handle the activities formerly undertaken by the Special Products Division, and Ultra Radio and Television, Ltd., will produce domestic radio and television.

EXPANDING CONSULTANCY.—Mr. J. E. D. Williams, B.Sc., F.I.N., A.F.R.Ae.S., has now formed a company, J. E. D. Williams and Co. (Aviation Consultants), Ltd., in order to facilitate his expanding activities in this field; the address is 33 Thurloe Square, London, S.W.7. Phone, Knightsbridge 8676. Formerly technical adviser to the managing director of El Al, Mr. Williams set up as an aviation consultant 21 months ago—during which time he has been retained by six airlines and two other companies.

DAGENITE BATTERIES. — Starting this month, Dagenite aircraft batteries, which have previously been distributed by Peto and Radford, will be marketed by the manufacturers, Pritchett and Gold and E.P.S. Co., Ltd., 137 Victoria Street, London, S.W.1.

BRYANS CHANGES. — Gp. Capt. P. W. S. (George) Bulman, who has been a director of Bryans Aeroquipment, Ltd., since 1945, recently resigned from the company's board because of ill-health. His place on the board has been taken by Mr. Kenneth J. Wilson, who is the son of the chairman of Allbright and Wilson. He is also a director of Becker Equipment and Lifts, and J. F. Crosfield and Park Hall Estates.

Aviation Calendar

January 25.—R.Ae.S. Henlow Branch lecture, "Flying Boats," by R. Stanton-Jones, in the Assembly Hall, R.A.F. Technical College, **Henlow,** at 19.45 hrs.

January 26.—Institution of Civil Engineers lecture, "The Planning and Design of Maintenance Bases for Civil Aircraft," by M. O. Measor, L. B. Haley and A. J. Harris, at the Institution, Gt. George Street, **London,** S.W.1; at 17.30 hrs.

January 26.—Royal Technical College lecture, "Orbits and Trajectories," by Dr. D. E. Bailey, at the Royal Technical College, **Salford,** at 19.00 hrs.

January 27.—R.Ae.S. Weybridge Branch lecture, "Testing at Supersonic Speeds," by Wg. Cdr. Beamont, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

January 27.—R.Ae.S. Graduates' and Students' Section lecture, "Problems and Prospects in British Aviation," by P. G. Masefield, in the Library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

January 28.—R.Ae.S. Belfast Branch lecture, "Aircraft in the Modern Army," by Maj. D. W. Leach, in the Lecture Hall LG8, David Keir Building, Queen's University, **Belfast,** at 19.00 hrs.

February 1.—R.Ae.S. Boscombe Down Branch lecture, "Long Range Missiles," by E. C. Cornford, in the Lecture Hall, A. and A.E.E., **Amesbury,** Wilts, at 17.30 hrs.

February 2.—R.Ae.S. Luton Branch lecture, "Development of the Rotodyne," by Dr. H. F. Winney, in the Napier Senior Staff Canteen, **Luton Airport,** at 18.15 hrs.

February 2.—R.Ae.S. lecture, "Suppression of Shock-induced Separations by Boundary Layer Control," by H. H. Pearcey, in the Library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

February 2.—British Interplanetary Society lecture, "The Use of Reinforced Plastics in Rockets," by A. Wilson, in the Lancaster Room, Caxton Hall, **London,** S.W.1, at 19.00 hrs.

Company Notices

New Companies

African Mercantile Co. (Overseas), Ltd. (645,194).—Private co. Reg. December 22. Cap. £500,000 in £1 shs. Objects: To acquire and carry on such part of the trading business of the African Mercantile Co., Ltd., as is carried on in Kenya Colony, Kenya Protectorate, Uganda Protectorate, Tanganyika Territory and Zanzibar, and to carry on the business of general commission agents, merchants; steamship and airline agents, etc. Directors: Wm. J. Saunders, Nyall, Stone Rd., Broadstairs, Kent; Geoffrey S. Hunter (no address stated); Kenneth R. Elder, The White House, Albany St., London, N.W.1. Sols.: Bircham and Co., 100 Old Broad St., E.C.2.

Menfield Aviation Co., Ltd. (645,491).—Private co. Reg. December 24. Cap. £3,000 in £1 shs. Objects: To carry on the business of air transport contractors, etc. The subscribers (each with one share) are: George Head, 230 Great Portland Street, W.1 (solicitor's managing clerk); James J. Gill, 5 George Street, W.1 (engineer). Director: Patrick Lawlor, of 62 Scarsdale Villas, W.8. Sols.: Stenning and Rudall, W.1. Reg. office: 62 Scarsdale Villas, London, W.8.

New Patents

APPLICATIONS ACCEPTED

828,111.—General Electric Co.—"Constant output control systems."—Aug. 29, 1957. (Aug. 31, 1956.)

828,416.—Salomon, F.M.M.B.—"Apparatus for subjecting a structure to alternating mechanical impulses."—July 16, 1958. (July 16, 1957.)

828,632.—Blackburn and General Aircraft, Ltd., and Gadd, R. C. S.—"Probes for use in refuelling aircraft in flight."—March 6, 1958. (Feb. 7, 1957.)

828,090.—Borchers, A. G.—"Structure adapted to be propelled by the kinetic energy of a current of fluid."—Dec. 10, 1956.

828,132.—Stoeckicht, W. G.—"Gearing—for driving two propeller shafts of a helicopter."—Feb. 10, 1958. (March 7, 1957.)

828,612.—Aerotecnica, S.A.—"Blade construction for rotary-wing aircraft."—Dec. 21, 1955. (May 4, 1955.)

828,492.—Switlik Parachute Co., Inc.—"Parachute pack."—Oct. 15, 1957. (Nov. 19, 1956.)

Printed specifications of the above will be available on February 17, 1960, and the opposition period will expire on May 17, 1960.

RECEIVERSHIP (RELEASE)

Bevan Bros. Aeronautical Engineers, Ltd. (440,382).—48 Conduit Street, W.1. Alfred Creed, of 47 Oxford Street, W.1, ceased to act as Receiver on August 5, 1959.

Personal Notices

BIRTHS

Boardman.—On January 6, at British Military Hospital, Berlin, to Mary, wife of Gp. Capt. Boardman—a son.

Brown.—On January 6, to Marguerite, wife of Sqn. Ldr. T. C. Brown—a son.

Curtis.—On January 7, at Grimsby Maternity Hospital to Jean (*née* Malinson), wife of Flt. Lt. S. Curtis—a daughter.

Davies.—On January 11, at 79 Weigall Road, S.E.12, to Brenda (*née* Cutts), wife of Flt. Lt. J. R. Davies—a daughter.

Gillam.—On December 31, at Oldenburg, Germany, to Mary (*née* Scott), wife of Flt. Lt. R. A. Gillam—a son.

Hitchcock.—On January 9, at R.A.F. Hospital, Changi, Singapore, to Pamela (*née* Gautrey), wife of Flt. Lt. K. J. Hitchcock—a son.

Isherwood.—On December 31, at March Maternity Home, to Diana (*née* Bailey), wife of Flg. Off. P. Isherwood—a daughter.

Lippett.—On January 8, at R.A.F. Hospital, Wroughton, to Sheila (*née* Smith), wife of Flt. Lt. B. Lippett—a son.

Waudby.—On December 31, at Landsberg, Bavaria, to Pamela (*née* Page), wife of Sqn. Ldr. W. N. Waudby—a son.

MARRIAGES

Clare—Twigg.—On January 4, at Bainagown Castle, Kildary, Sqn. Ldr. Arthur Clare, R.A.F. (Retd.), to Pamela Ruth Twigg, of Stafford.

Venn—Cholmeley.—On January 1, at Christ Church, Mayfair, Air Cdre. G. O. Venn, R.A.F. (Retd.), to Monica Cholmeley.

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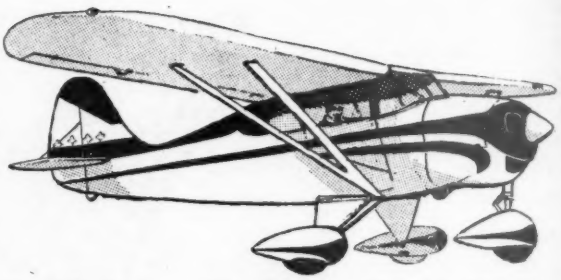

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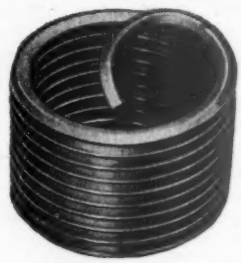

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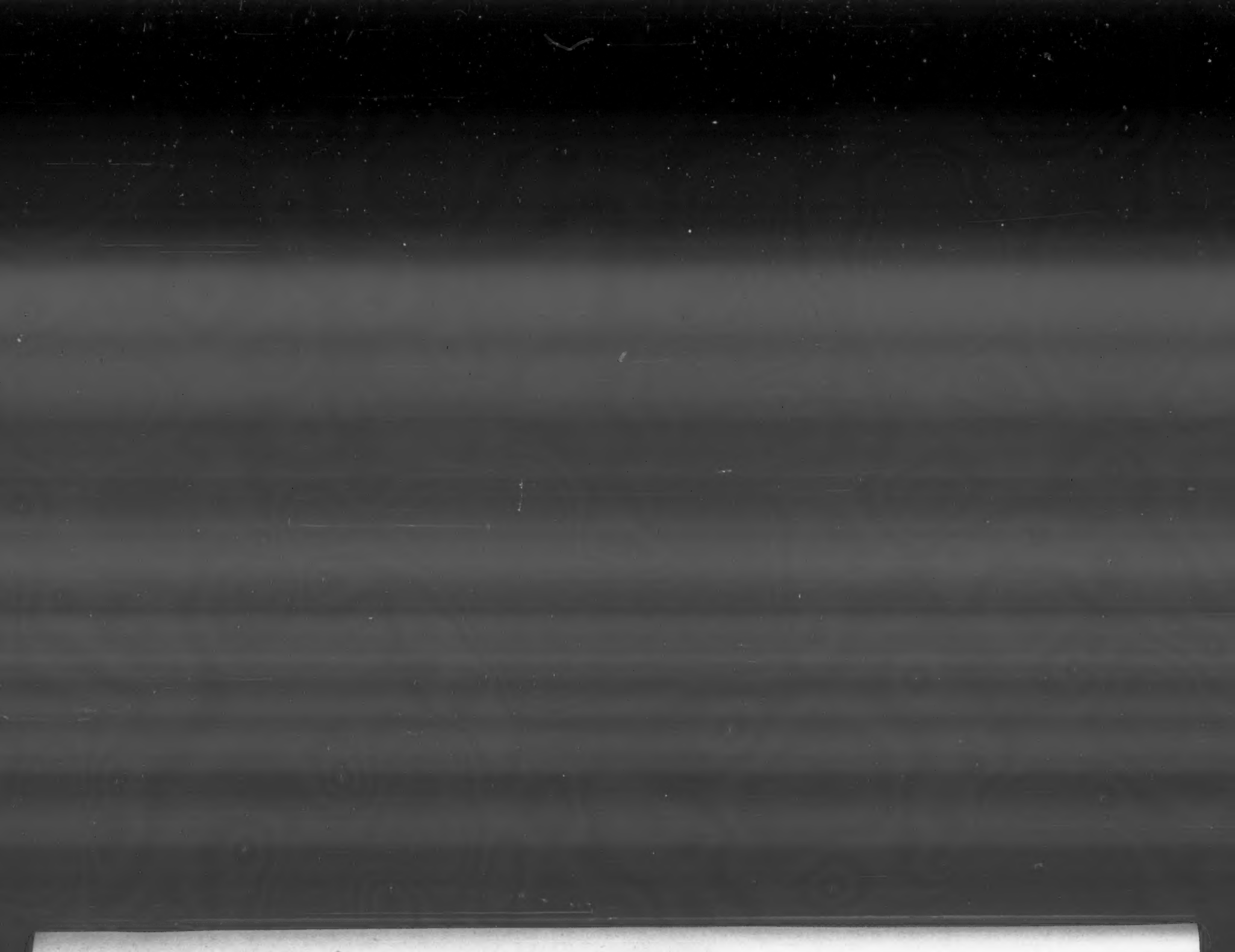
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